

PC MAGAZINE

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FREE PCs

What You Really Get



● First Looks:
Pentium III PCs
Hit 550 MHz

● PC Labs Tests
27 New Fast
Laser Printers

● John C. Dvorak:
New Trends in
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THE INDEPENDENT GUIDE TO PERSONAL COMPUTING AND THE INTERNET

VOL.18 NO.11 JUNE 8, 1999

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Welcome to Our Labs

Recently, I had the experience of walking into PC Magazine Labs for the first time. That sounds strange, because we've run a product-testing lab for 15 years. But this was an all-new Labs, designed for a new era. You see, *PC Magazine* is on the move again, this time literally.

Long-time readers know that the magazine and its parent publisher Ziff-Davis have been housed at One Park Avenue in New York for many years. But over the past few weeks, we've packed up everything and moved to our new headquarters a few blocks away, at 28 East 28th Street.



Many of us have been with the company for years, so going through our offices to pack for the move was a bit like rummaging through the attic. Some of the items we came across belong in a time capsule.

For instance, I came across old issues of *PC Magazine*, including those where we first started labs-based testing with hundreds of printers. I found press kits for all sorts of old products—and a lot of old software. The things worth keeping were crated and moved to our new building. But the age of those items is merely an indication of just how much things have changed.

Our new offices—which you can see in more detail on our Web site—bring us closer to a part of New York known as Silicon Alley. A few years ago, such a name would have been laughable; now it's commonplace.

Everyone on staff is excited about our new offices, and not only because the offices themselves are new. The best thing, by far, is the new PC Magazine Labs. As Labs director Steve Buehler details in the column *Inside PC Labs* (page 29), the new facility has some 8,000 square feet of testing space, including 98 benches for testing hardware, software, networking, and Internet products.

We had very nice labs at the One Park Avenue facility, but they were designed for testing PCs and associated products in an era when speed and compatibility were top priorities. But times change, and so has our testing. We still need to look at performance and features, but now we are just as likely to be testing Internet connectivity, networking features, ease of use, or manageability.

The new PC Magazine Labs is specifically designed to let us test products in the Internet era. For instance, every bench allows Internet connections in multiple ways, from Fast Ethernet to traditional analog lines. Making this all work requires dozens of miles of special cabling. And we are now set up with many different machines solely for viewing Web sites using different browsers and all sorts of different networking configurations.

Of course, change is a part of everything. When Ziff-Davis first moved into One Park Avenue, it was a publisher of magazines for many special interests. Over the years, this included such titles as *Car and Driver*, *Modern Bride*, *Popular Electronics*, and *Popular Photography*. About 15 years ago, the company changed its editorial focus to computer publications.

Other things have changed as well. When *PC Magazine* moved into One Park Avenue in 1983, we never thought about cable TV. Now the Labs are wired with cable, because we need to test products that integrate computers and consumer electronics.

But one thing hasn't changed: our commitment to testing products so you can find the computing and Internet solutions right for you. Testing at the new PC Magazine Labs—and at ZD Labs in Foster City, California—will help us continue on that mission. **PC**

More on the Web:

Editor-in-chief
Michael J. Miller
answers your computing
questions every Tuesday,
exclusively at *PC
Magazine Online*.

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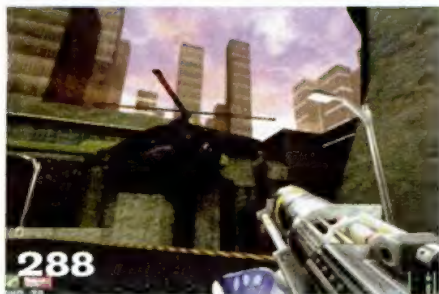
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Cover: Illustration by Tom White; photography by Thom O'Connor



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¹U.S. Dept. of Commerce "The Emerging Digital Economy," 1998 ²Life of fund is as of inception date: 2/4/98. ³Life of fund is as of inception date: 6/29/90. ⁴Average annual total returns include changes in share price, reinvestment of dividends and capital gains, and each fund's 3.00% sales charge and trading fee. Share price and return will vary and you may have a gain or loss when you sell your shares. All Select equity portfolios have a \$7.50 exchange fee and a 0.75% short-term trading fee on shares held 29 days or less. On shares held 30 days or more, the trading fee is the lesser of \$7.50 or 0.75%. Fidelity Distributors Corporation.

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Waiting for Win 2000

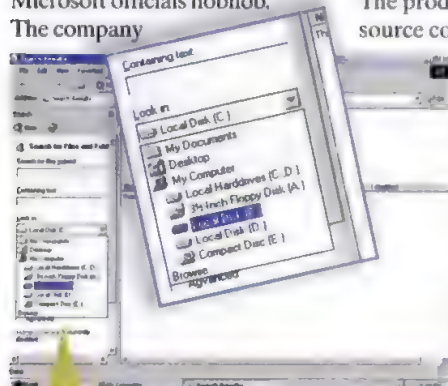
The demonstration of the upcoming Microsoft Windows 2000 operating system was among the highlights at this year's Windows Hardware Engineering Conference (WinHEC) in Los Angeles, where hardware engineers and Microsoft officials hobnob. The company

high-end database queries, the 64-bit version of Windows 2000 (formerly Windows NT 5) should ship in the 2000 to 2001 time frame. Microsoft is developing the 64-bit version in tandem with the 32-bit version, which will ship later this year. The products have the same source code but different

compilers.

The 64-bit version will allow for up to 8 terabytes of memory, compared with the 4 gigabyte limit that this year's 32-bit version will support, says Microsoft president Steve Ballmer. The extra memory support in the 64-bit version is expected to give applications such as high-end databases a big performance boost.

During Ballmer's address at WinHEC, the 64-bit version was shown querying a SQL server on a four-way Compaq Alpha server. Ballmer claimed that the query, which took under a minute to run, would have taken over 10 minutes using the 32-bit version of Windows 2000.



Windows 2000 continues integrating the browser and the OS. Within Internet Explorer, you can do a keyword search on a local disk and results will show up on the browser window's right side.

showed off Windows 2000's advanced power management, support for four-way clustering technology, and storage area network management, but the first showing of a 64-bit version of the operating system took center stage.

Aimed squarely at enterprises focused on such tasks as

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Are you a chronic oversleeper in dire need of assistance? You might want to try iPing's Mr. Wakeup, a free Web wake-up and reminder call service. Traditional wake-up call services charge a fee for each call, but the Mr. Wakeup service is supported by advertising: Each wake-up call includes a message from the call's particular sponsor. You can go online at www.mrwakeup.com, schedule a date and time, enter your phone number, and then go to sleep. iPing uses text-to-speech technology to convert your message into spoken words over the phone. The service can also provide news, weather, and horoscopes. The default voice is a synthesized computer, but new voices will be added soon. And there's an option to record your own greeting so you can wake yourself up.



Robo-Pup

For hard-core early adopters only, Sony's R & D lab in Tokyo has just released a robotic pup that packs the power of a workstation. Developed to showcase what cool toys may be in the hands of the next generation, the Sony ERS-100—known affectionately as Aibo (for *artificial intelligence robot* as well as the word for *friend* in Japanese)—starts its exhausting day with a 40-second boot up, followed by a good stretch and a yawn.

Aibo can perform tricks such as lying down, getting up, and shaking hands. With the help of infrared distance sensors in his eyes and a snout-based CCD camera, Aibo can chase a colorful ball. A microphone lets it hear when it is called; Aibo responds by cocking its head in that peculiar puppy

way in the caller's direction.

The included software lets you program Aibo's movements from your PC and store them on a removable Sony Memory Stick.

Aibo's creator, Takeshi Yazawa, general manager of the Entertainment Robot Business Incubation Department at Sony, says a team of 24 researchers spent five years creating Aibo. The 3.5-pound pup can run for about 1.5 hours on its lithium ion battery before it needs a 3-hour nap in its recharger unit. Yazawa dreams of developing a more evolved Aibo that can learn to speak English and recognize faces.

Sony is producing a limited litter (2,000 for the U.S. and 3,000 for Japan) at a cost of \$2,500 per pup, available for purchase only on the Web at www.sony.co.jp/robot. An exclusive video of Aibo in action is available at PC Magazine Online at www.pcmag.com.



DNA Devices

DNA may one day form the basis of tiny electronic devices. Or it may even act as a repair mechanism on the DNA helix itself. The secret is conductivity. Previous experiments to determine whether DNA can transport electrons have proved inconclusive. New research by University of Basel professors Hans-Werner Fink and Christian Schönenberger, published in the science journal *Nature*, has shown that DNA can transport electrical current as efficiently as a good semiconductor.



Cellular Jolt

With cellular phones in use by nearly half a billion people worldwide, scare-mongers continue to predict new and more varied forms of long-term health damage. The reality may be quite the opposite. A recent study funded by the British Department of Health, carried out at the University of Bristol, and published in the *International Journal of Radiation Biology* examined the actual effects of cellular phones on human physiology.

Allaying fears that cell phones scramble or cook users' brains, the study indicated that phone emissions have a peculiar and as yet unexplained effect on human tissue. The researchers, using a headset that mimicked the emissions from cellular phones, discovered that people reacted 4 percent more quickly to memory tests when the device was switched on. The emissions from cell phones appear to cause slight heating in part of the brain and seem to produce a coffee-like jolt to mental capacity. Explanations for the phenomenon include the possibility that radiation could alter the structure of body compounds, creating heat-shock proteins, or that the microwave radiation interferes with the minute electromagnetic emissions human cells produce. The long-term effects have yet to be determined.



Info Gap Widens

For all the talk about how the information economy is sweeping the globe, 40 percent of the world isn't even in the game—a sobering statistic. According to the 1999 IDC/World Times Information Society Index, which tracks 55 countries that account for 97 percent of the global GNP and 99 percent of IT expenditure, the U.S. remains the world's dominant information economy and the info gap between rich and poor countries continues to widen.

"What concerns me are the 150 or so countries not included in our index, which account for 3 percent of the world GNP and less than half a percent of all information technology expenditures," says Wilford Welch, director of global research at World Times. "This is about 40 percent of the world population, and they aren't even in the game," he says.

Information-Rich Economies



THIS ISSUE'S CONTRIBUTORS: Carol Levin, Sharon Nash, Sebastian Ruple



The Mobile Portal

Mergers among Web portals have been all the rage lately, but another portal strategy picking up momentum is the delivery of Web content to alternative hardware gadgets and appliances. Yahoo! is actively seeking to seed its portal on non-PC devices, including hand-helds and Web appliances such as WebTV. The company recently announced a partnership with Online Anywhere, which provides a technology called Flash-Map to let content providers reformat and package Web content for hand-held computers, televisions, pagers, and Internet appliances. Yahoo! also has a deal with PageNet to provide content, e-mail, and calendar services to PageNet subscribers wirelessly.

Through its acquisition of Netscape and partnership with Sun Microsystems, AOL is also aggressively pursuing delivery of Web content to wireless appliances with its AOL Everywhere strategy. Meanwhile, Oracle is working on Project Panama, designed to let Web users construct personal portals accessible from cell phones.

Top-Selling Games

1	SimCity 3000 Maxis
2	Heroes of Might and Magic III 3DO
3	Sid Meier's Alpha Centauri Firaxis Games
4	EverQuest Sony
5	Cabela's Big Game Hunter 2 Activision
6	Frogger Hasbro Interactive
7	Baldur's Gate Interplay
8	Monopoly Game Hasbro Interactive
9	Starcraft Havas Interactive
10	Deer Avenger Havas Interactive

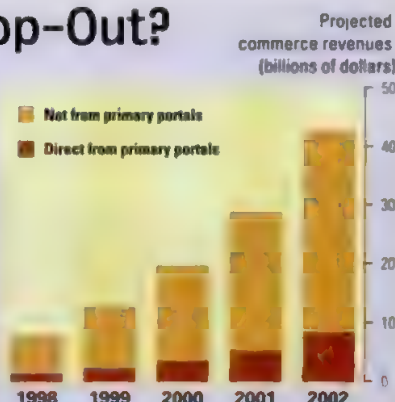
Source: PC Data, March 1999.

Anti-Virus Avalanche

The Melissa virus may have caused an uproar, but anti-virus software developers aren't complaining. Retail sales of virus-detection software increased 67 percent during the week of the scare, according to market research firm PC Data. From March 28 to April 3, sales of Symantec's Norton AntiVirus increased 78 percent, while Network Associates' VirusScan and Dr. Solomon's Anti-Virus increased 51 percent. With anti-virus software installed on only 35 percent of U.S. and Canadian PCs, analysts predict Melissa will be a wake up call to companies that previously felt no need for the software.

Portal Poop-Out?

Despite the stock market's expectations of gigantic revenues from portals conducting e-commerce, recent figures from Jupiter Communications indicate an upset. In 2002, online commerce driven directly by primary portals will still account for only a small fraction of total commerce revenues.



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A hearing will be held at the Hall of Justice, 101 S. 5th Street, Camden, New Jersey in Courtroom 52, before Judge Fluhardy at 2:00 PM on Friday August 6, 1999 (the "Settlement Hearing") to determine: (1) whether the proposed settlement of this action is fair, reasonable and adequate; (2) whether a final judgment should be entered dismissing the litigation on the merits as to Franklin with prejudice to plaintiff and all members of the Settlement Class who do not timely request exclusion; and (3) whether applications to be made by Class Counsel for payment of fees and reimbursement of expenses and an incentive fee award to plaintiff should be approved by the Court.

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Dated: April 5, 1999 By Order of the Superior Court of New Jersey, Law Division, Camden County.



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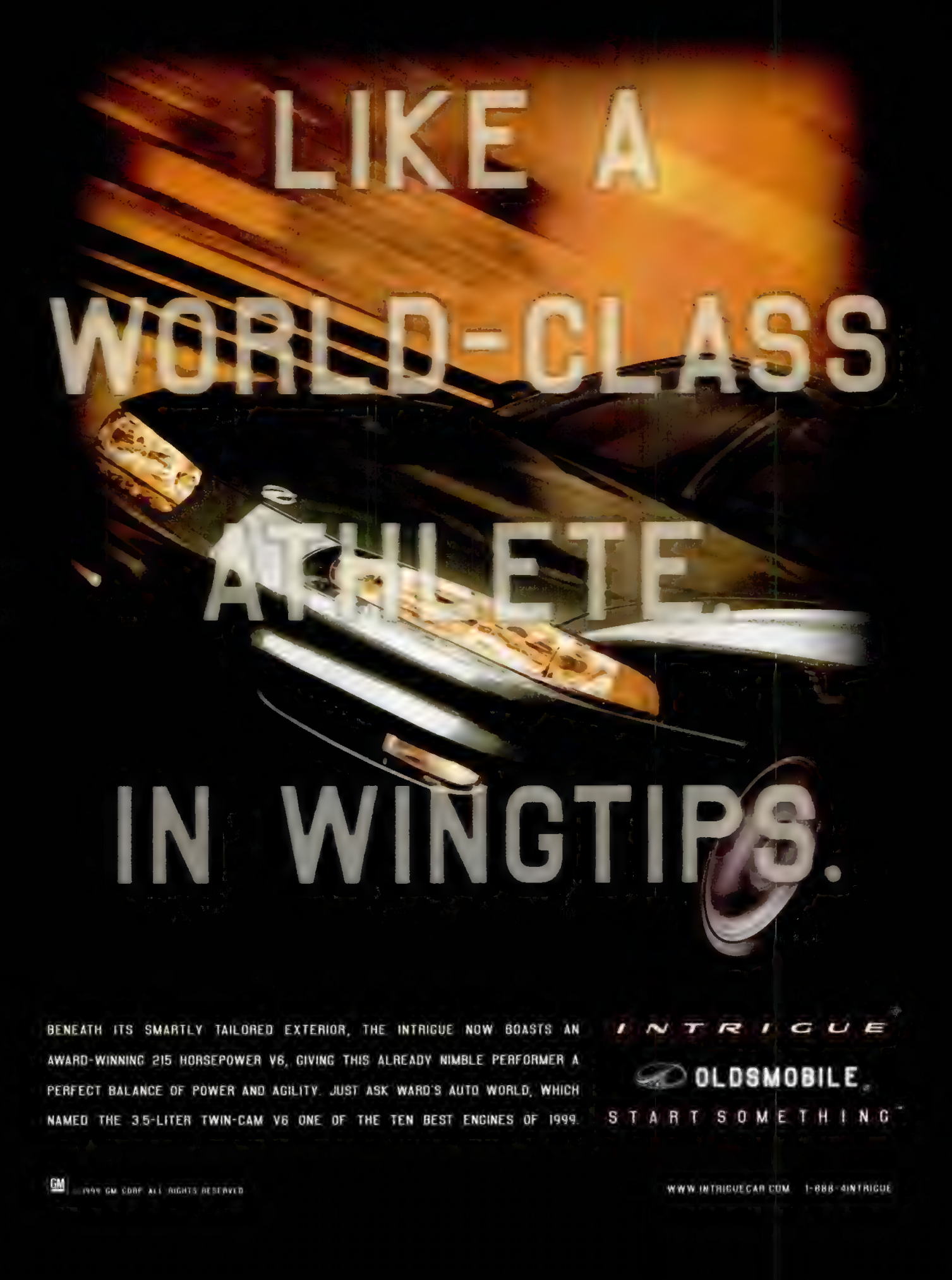
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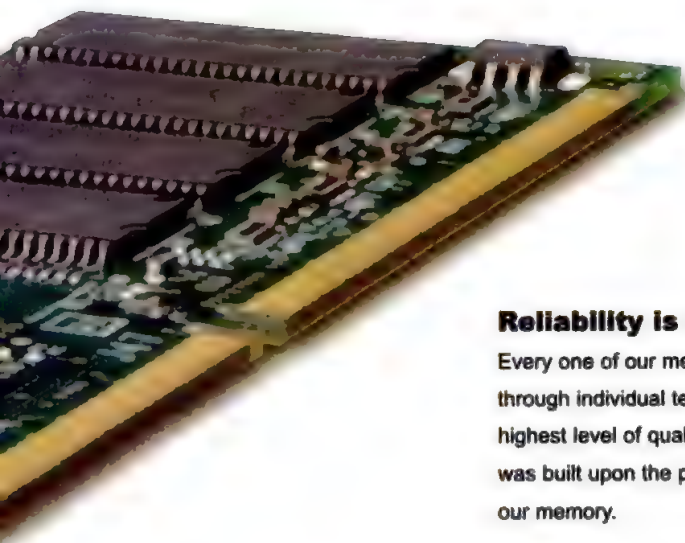
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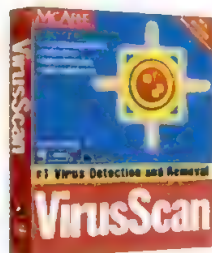
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LETTERS

BUILT FOR SPEED

I appreciate your coverage of the faster methods one can use to connect to the Internet ("Faster Web Connections," April 20). There is a major issue that you did not cover in the article, though. If just a few people obtain the "faster" service, then everything will work fine. But if many people obtain the service, the result will be significantly slower connections, and access fees may rise.

The first problem is the neighborhood cable-modem and phone-company ADSL concentrators. These devices have a maximum per-second capacity that limits those connected to them. So if your whole block has cable-modem access, you compete with your neighbors for the bandwidth, which can have a serious impact at peak times. The next problem in the chain is the speed at which these neighborhood devices are connected back to the switching centers. The biggest problem of all is that if everyone were to upgrade, the current Internet backbone links of ISPs would be brought to their knees. The cost to upgrade ISP backbone links to accommodate the new capacity requirement would be huge. Guess who would have to pay the bill? That's right, the consumer. A fact that is always overlooked is that Internet backbone links are a mere shadow of the telephone-company links installed for voice calls.

Why do I bring this up? Most Internet companies and magazines say, "Won't it be great when everyone has high-speed access in their homes and offices?" Yes, it will be, but let's come back down to earth. Given the lack of availability, high costs, limitations of the current Internet infrastructure, and slow upgrade times where phone and cable companies are involved, this isn't going to happen anytime soon. Real products will have to live with the current bandwidth and not require or depend on everyone upgrading.

JEFF ADAMS
via the Internet

Your article was well presented and informative. The comparisons of throughput from

various cable and xDSL providers is particularly enlightening. But the table entitled "Fast Connections Compared" (page 160) is slightly misleading. It states that DirecPC users can receive calls when the line is in use "except when uploading." This is technically true, but average readers are likely to think it means that they can use the phone while surfing the Web as long as they aren't "uploading" files.

In reality, using the Internet even for Web surfing alone results in the upstream phone line being used for DNS queries (as your article states) as well as for sending HTTP requests to servers. This is uploading, to be sure,

If everyone were to upgrade, ISP links would be brought to their knees.

but the average user tends to think of uploading as purposefully initiating a transfer to some other machine.

Other than a push application, I can't think of anything that is purely downstream. Even FTP downloads require periodic input from the client.

DYLAN GORDON
Calgary, Alberta, Canada

SERVICE WITH A SMILE

Your roundup of ISPs covered an important topic, but I felt it came up short in several respects ("At Your Internet Service," April 20). In your table of contents, you mention dropped connections as a key issue—which it is—but the article makes no mention of it, nor do you rate the ISPs for this problem. In my experience, disconnects have a much bigger impact on service quality than a few extra seconds for a major download do. Also, it would have been beneficial to explore the alleged dirty secret of the ISPs: intentional disconnects of clients with unprofitable usage patterns or to free up modems for big commercial customers.

Also, for the performance tests, you did not publish actual results for below-average ISPs. I understand this was a condition of using third-party test data, but it sets a most unfortunate precedent. You aggravate the problem by pointing out that a below-average performer may be only 0.1 percentage points worse than average. And I would have found it helpful if the article had covered situations in which you are satisfied with your existing Internet client software and don't want it disturbed by installing ISP-provided software. What do the ISPs' installers do to your system

in these cases? Do you have to use their software at all? Last, it would have been helpful for international travelers to learn about local-access coverage outside the U.S.

PETER MARTIN
via the Internet

FAST AND FURIOUS

Michael J. Miller's column "The Future Web: Beyond Fast" (April 20) contains a truth that deserves amplification: "We also require an OS that is designed to be on constantly,

and Windows 98 just isn't there yet." Windows 98 (along with much of Microsoft's product line and corporate philosophy) blithely ignores the reality of everyday work requirements of people who depend on the stability of their operating systems and applications.

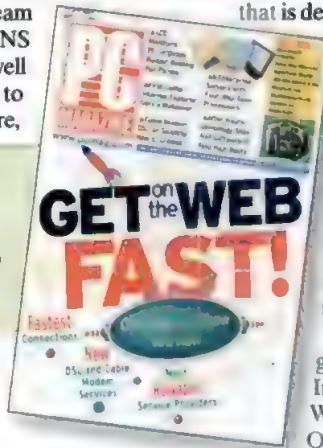
My personal work regime requires the services of Internet Explorer, Outlook, Word, Excel, PowerPoint, Quicken, WinFax, Paperport, Access, Project, Visio, WinZip, and several other lesser-known apps. My system invariably requires a reboot (most often due to shrinkage of the user resource) after 4 or 5 hours. Compare this performance with that of other consumer products. Would you be happy with a refrigerator that had to be turned off and restarted every few hours to keep your food from spoiling? It seems to me that someone at Microsoft should have noticed by now that we've gone far beyond the days when computer users were nerds who put up with this kind of nonsense. *PC Magazine* should start giving awards for reliability and rejecting products that need any kind of tweaking to stay running. And users and MIS departments could simply stop buying products that aren't stable.

BILL PETERSON
via the Internet

A COOL NOTION

Although I applaud Frigidaire's desire to capture the predicted surge in family Internet usage by designing a refrigerator with a built-in computer ("Hungry for the Web?", Pipeline, April 20), I wonder at the wisdom of this idea. As a systems analyst, I'm frequently surprised at the way most users will do something they've been warned not to do and then become irate when their PCs refuse to recover and function properly. Why do I mention this? Have you ever seen a family fridge with fewer than 25 magnets stuck to it?

EVAN WADE
via the Internet



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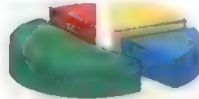
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FAMILY VALUES

I've been a long-time reader and enthusiastic supporter of your magazine since its inception: I'm also a genealogist, having pursued this hobby for more than 35 years. I use all the genealogy programs recently included in your genealogy article "Chart Your Past" (After Hours, April 20). This is because each of these programs has at least one feature—normally a report—that is not offered by the others. The finest program on the market and the one I use as my primary database was not even mentioned in the article. Family Origins, from Parsons Technology, has the best combination of ease of use, powerful source/citation capabilities, and reporting features. Any further articles on genealogy programs should certainly cover it.

PAUL M. NOYES
Lilburn, Georgia

I have purchased two of the programs that were reviewed and have returned both to the vendors. I had at least these two problems with each. The first is that printed ancestral charts are limited to 50 generations. That restriction limits the genealogist to charts that cover only the most recent 1,500 years or so. Many genealogists can trace family lines back to at least A.D. 6, or over 70 generations. The second problem is that names, titles, and locations are limited to 16 characters. English royalty titles frequently are significantly longer—for example, Duchess of Northumberland.

WILLIAM SHELTON
via the Internet

NO PAIN, NO GAIN

I couldn't have agreed more with Michael J. Miller's column "Why Y2K Is Good for You" (April 6). I just started working at an investment firm that has a number of independent consultants managing IT. As you can imagine, the department is an organizational nightmare. Our Y2K project is not only helping us understand and document the current systems, it is actually clarifying what our systems should be in the future.

JOHN REGAN
via the Internet

SETTING THE STANDARD

I have been in the computer business since the tail end of punch cards and am not easily impressed. But your "Inside PC Labs" column of March 23, wherein you checked up on graphics cards sent to you for review versus cards actually offered to consumers, set the mark for magazine integrity. Like many, I have spent money based on the PC Magazine Editors' Choice logo. If I once worried about possible hidden agendas in test results, I certainly don't anymore.

DAVID WILLIAMS
via the Internet

Corrections and Amplifications

In our story "Faster Web Connections" (April 20), we mistakenly stated, "We also signed up for IDSL service, which gives you 144-Mbps uploads and downloads, in Foster City, California." The correct upload and download speed for this service is 144 Kbps.

In the SiteFinder column "Starting a Small Business" (Trends, April 20), we incorrectly stated that ONElist limited users to mailing lists of 250 people. In fact, ONElist imposes no limit on the number of names on an e-mail list (www.onelist.com).

In our story "At Your Internet Service" (April 20), we printed an incorrect phone number for Mindspring. The correct number is 888-677-7464.

CHILD'S PLAY

Re Bill Machrone's "The Kids Are All Right!" (April 20): I'm all in favor of encouraging kids and do as much of it as I can myself, but I try to avoid misleading them. Nothing's impossible? Here's something that's impossible: an apparatus that delivers more energy than it has provided to it. Maybe that's not what Machrone was thinking of with his "germ of an idea" for a self-recharging battery, but it certainly sounds like perpetual motion to me.

I consult for a company engaged in development of fuel-cell-powered vehicles that generally use hydrogen for fuel, with water as a by-product. When people remember that hydrogen is available from the electrolysis of water, an amazing number suggest that this is great, because all you need to do is capture the water from the exhaust, decompose it with the electricity from the fuel cell, and put the hydrogen back into the fuel cell to run the vehicle. This would indeed be a self-recharging battery, or the closest thing to it—if that weren't impossible in the absence of another energy source.

I hope Machrone's first step was to distinguish between projects that are held up only by lack of imagination (which the kids evidently had in bags) and those that really are impossible.

DAVE MACMURCHIE
via the Internet

A HOST OF PROBLEMS

I read your article "A Web Site of Your Own" (April 6) and wondered if you were planning to review any commercial (domain) hosting sites. The companies behind them generally deliver the worst imaginable customer service, in most cases to the extent that their services become unusable. As a Web developer, I have several sites hosted by various companies. In over four years, none of them has once managed to attend to a problem within less than ten days. Not only do they take ages to investigate a problem, in most cases nobody bothers to reply to e-mail. Their networks, in general, are rather shaky, with servers and services going down regularly for prolonged periods. Even with planned maintenance, they don't tend to forewarn their customers of planned downtime. Then I have to explain to my customers why they suddenly can't have 20 POP accounts any more or

why everyone in the company must suddenly use the same account.

Commercial hosting companies need a serious wake-up call. They are going to have to reconsider their support levels and their generally condescending attitudes toward clients. The industry's mind-set seems to be, "We make money. You pay. You get what you get, and don't expect us to take responsibility for our bad service." Anyone out there want to make a billion? Just start up a hosting company with good customer support.

DANIE BRINK
via the Internet

A LITTLE SIMPLER, ANYWAY

In his letter of April 6, John Burch complains that the acronym WWW has nine syllables and needs to be replaced by something simpler, such as Q. Mr. Burch will be pleased to learn that, although the ultimate goal of just one syllable has not yet been attained, people in our part of the country have already reduced the problem by a third. We pronounce WWW with just six syllables: *Dubuyuh dubuyuh dubuyuh*.

JOHN AND SUSAN SEATER
Raleigh, North Carolina

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The View from Microsoft

Imaginative hardware designs, easy server appliances, and wall computers with flashy 3-D interfaces are on the drawing board.

Every year, when Microsoft invites hardware engineers to its Windows Hardware Engineering Conference (WinHEC), attendees get a sneak peek at where the PC platform is headed. This year's conference in Los Angeles was no exception, as Microsoft president Steve Ballmer and hardware strategist Carl Stork mapped out new directions for Microsoft—from new 3-D software interfaces to networkable knickknacks for the home.

Ballmer opened the conference by pointing out that in the early 1980s, fewer than 3 million PCs were sold each year, and that this year 100 million PCs will be sold. Meanwhile, processing power, measured in millions of instructions per second, has plummeted in price from about \$5,000 per MIPS in 1985 to about \$1.78 per MIPS today.

Microsoft expects to ship Windows 2000 by the end of this year, and in the 2000 to 2001 time frame, Microsoft will deliver a 64-bit version of Windows 2000 (see this issue's Pipeline). Ballmer stressed that in order for 64-bit computing to succeed on the PC platform, hardware vendors need to improve I/O architecture, increase redundancy in systems, and optimize networking. Microsoft will continue to develop the Windows 9x consumer operating system line for several years to come, rather than phasing it out as Windows 2000 arrives.

Ballmer characterized PC hardware design today as unexciting (perhaps a reference to the innovative Apple iMac). Among the

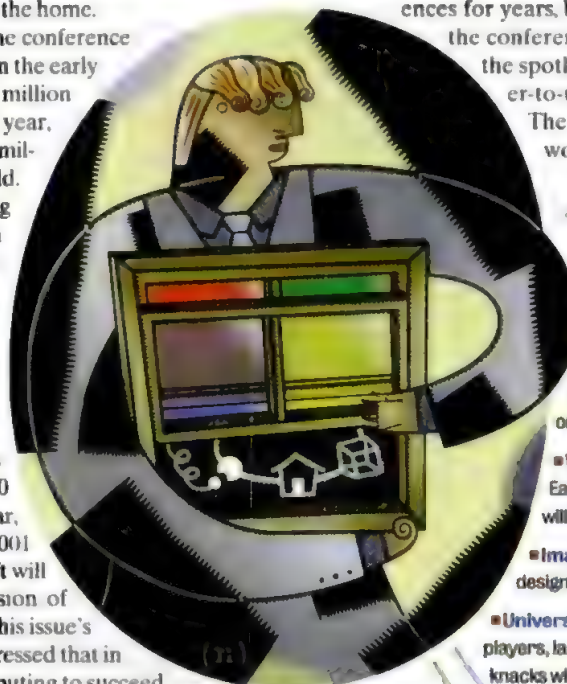
concept devices he showed was a purple, oddly shaped CD-ROM drive from AMD, which has a CD-ROM standing vertically in the device and a door that you can open to view the spinning disk. He also showed racy-looking flat panels.

NO-BRAINER SERVERS

Microsoft has been pushing the concept of desktop ease of use at its WinHEC conferences for years, but this year

the conference also cast the spotlight on easier-to-use servers.

The company is working with hardware



WinHEC Highlights

■ **Windows 2000:** The 32-bit version is due in October of this year; a 64-bit version is due in 2000 or 2001.

■ **Windows Server Appliances:** Easily configured servers under \$2,000 will ship in volume this year.

■ **Imaginative designs:** Racy hardware designs are on the drawing board.

■ **Universal Plug and Play:** CD players, lamps, and other knickknacks will be networked.

■ **New 3-D interfaces:** Active Hallway is coming to wall computers.

vendors on a new class of machines called Windows Server Appliances, which target home networks and small businesses and will ship by the end of this year.

In a demonstration of one of the appliances, the first feature that popped up on the system's built-in LCD was a configuration

wizard. The wizard automatically sets up a network printer, an Internet connection for use by all networked PCs, and file sharing. "There are a lot of folks out there who want to buy an inexpensive server for file sharing, printer sharing, and sharing an Internet connection who don't want to hassle with configuring and maintaining a server," Ballmer said. Windows Server Appliances will cost under \$2,000 and will forgo complicated administration and security features.

Microsoft's new Universal Plug and Play initiative is central to new kinds of networked "smart objects" for homes and businesses. During a demonstration, Ballmer showed a dual CD player for music, several sets of speakers, and USB/FireWire devices all featuring network connections and Universal Plug and Play software from Microsoft. A tabletlike device can be used to roam around a home and wirelessly activate music CDs and other home functions, such as lighting. Windows CE will support Universal Plug and Play so that hand-helds and other CE-based units will be able to connect to many more kinds of devices than they can now.

Dan Robbins, a researcher at Microsoft Research, showed one of the glitziest technologies at WinHEC: a 3-D

graphical user interface designed to use home and hallway metaphors to help users navigate the Web, documents, and other kinds of information. The new software was reminiscent of Microsoft's failed interface of years past—called Bob—but the new interface is much more eye-catching.

Robbins suggested that the interface could show up soon in wall computers for high-tech homes. In

his demonstration, he strolled down a virtual hallway with customized wallpaper populated with ActiveX and Java animations. Ballmer called the demo "one of the most exciting things we're working on at Microsoft."—Sebastian Rupley



Steve Ballmer



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Palm Apps Preview

3Com Palm devices and the Palm operating system remain the leaders in the U.S. mobile computing world, with a 40 percent market share in 1998, according to market research firm Dataquest. In response to the recent release of the 3Com Palm V and Palm IIIx and the upcoming release of the Palm VII, developers are bringing online-trading, speech-recognition, and database software directly to the Palm.

Discover Brokerage and Aether Technologies plan to duplicate the desktop online-trading experience on mobile devices. Using a



real-time trading application developed by Aether, Discover Brokerage customers will be able to use their Palm or Windows CE devices to manage their portfolios, conduct trades, track their accounts, and receive real-time quotes. The service should be available by June.

The Dragon NaturallySpeaking Mobile Organizer is a hand-held device that records, transcribes, and analyzes your speech so you can create e-mail and calendar entries simply by speaking into it. It organizes your dictation into action categories, which you can then review and change if necessary. The device then instructs applications on your Palm to take appropriate actions. The Organizer also supports Microsoft Outlook 98, Lotus Notes, GoldMine, and Symantec ACT! 4.0. The device will cost around \$300 and should ship in the second quarter of 1999.

3Com and Sybase have announced an alliance to develop wireless enterprise applications for Palm devices. With Sybase SQL Anywhere Studio's UltraLite and MobiLink technologies, and 3Com's CodeWarrior development tool, the companies plan to improve wireless data synchronization for remote enterprise users. UltraLite requires about 50K, making it suitable for Palm and Windows CE devices with limited memory capabilities.—*Sharon Nash*



PC Labs: New and Improved



As the independent guide to personal computing and the Internet, *PC Magazine* is continually adapting to the rapid changes in computing technology. We will never lose our focus on comprehensive product evaluations, but we've found that our readers are asking for more information about a wider range of software, hardware, and "otherware" than ever before.

To provide you with the best buying information, the new and improved PC Magazine Labs, located in the new Ziff-Davis corporate headquarters in New York, is equipped to help us better evaluate the computing and Internet technologies you use today and will use in the future. And we're now at least as Internet-driven as the companies whose products we write about. Because you're doing so much more on the Internet, we're once again enhancing and improving our testing practices here in the Labs.

The 98 test benches has eight network connections, a fiber-optic connection, and cable TV and cable modem access, so new products that connect to the Internet will be able to show their stuff in the most accurate way possible. The network uses auto-sensing 10/100 Fast Ethernet connections to the benches, with Gigabit Ethernet on the backbone.

We've also added extensive controlled tests that reliably simulate all kinds of Web environments as well as live tests over the same environments businesses face every day. By doing this, our accurate and repeatable Labs-based testing is complemented by real-life test scenarios. This balanced approach to testing gives you the best information possible—the best of the lab world and the real world.

We've also enhanced our product integration testing using Internet test-beds that accommodate almost any new

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- One 125-kilowatt power distribution unit
- One 15-Amp isolated ground circuit per bench (for each of the 98 benches)
- Four quad electrical outlets per bench, with built-in surge suppression
- One 60-ton air conditioning unit
- Three 5-ton supplemental air conditioning units

Before we test any new product, we now ask how it plays in the Internet world. For many of the product categories you read about, we've augmented our benchmark and hands-on testing with enhanced ease-of-use testing. You can find these scripts on our Web site and compare your own products with our Editors' Choices. Since many of you are purchasing PCs to get on the Web, we're making sure to evaluate the steps manufacturers have taken to make your computing experience easier and faster.

With high-speed Internet access via digital subscriber lines, we can test in environments similar to our readers. Every one of

hardware, software, or middleware product, and we're adding the capability to test Internet services. Since many of you are purchasing bundled or outsourced services such as e-mail, Web site management, virtual private networks, remote access, and even entire e-commerce sites, we're adding comprehensive testing of these approaches to help you decide which end of the build-or-buy spectrum suits you best.

These are exciting times in the computing world, and PC Magazine Labs is continually improving to provide you the best product and Internet information available anywhere.—*Steve Buehler*

IMAGING

The Next Wave(let)

Despite their different aesthetics, professional artists, business users, and home enthusiasts all agree on one thing: They need a graphics file format that makes digitized images easier to create, use, and manage. The ideal format would be an open industry standard—one that every application could read and write. It would compress high-resolution data into very small files that would be convenient to store and transport. And it would enable a single file to be repurposed for everything from high-quality printouts to Web-based viewing.

Due next year, the new version of the JPEG (Joint Photographic Experts Group)

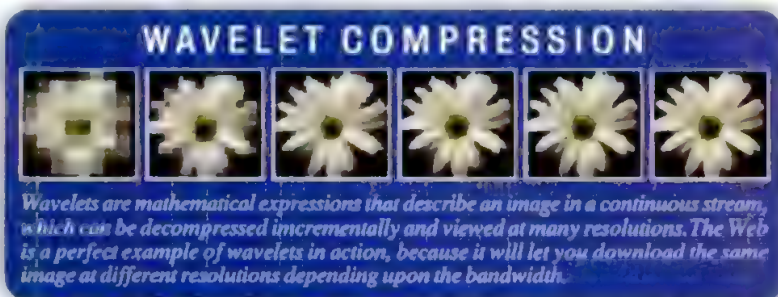
image format promises to deliver these features—and much more. JPEG 2000 is a fundamentally different file format from the JPEG in use today. The current version of JPEG can achieve high compression ratios, but its lossy compression technique and data-encoding method (Discrete Cosine Transformation or DCT) ultimately degrade images, both by discarding high-frequency

high compression ratios and still guarantees high image quality. On the simplest level, JPEG 2000 will offer both lossy and lossless compression. More important, it abandons DCT in favor of wavelet compression. Wavelets are mathematical expressions that describe an image in a continuous stream, and so avoid the blocky artifacts associated with DCT compression. As an added benefit, the

continuous wavelet stream can be decompressed incrementally, so the same file can be viewed (or printed) at a multitude of different resolutions.

The Internet provides a perfect example of wavelet technology in action. It lets you download the same image at different resolutions depending upon the available bandwidth.

With a T1 link, you can choose to download more of the wavelet stream (for higher resolution display) than with a 56K connection.—Luisa Simone



color information and by dividing an image into compression blocks often visible in solid areas or along color boundaries.

By contrast, JPEG 2000 delivers extremely

Getting Real About Getting Organized



Jake Kirchner

In my job, I can easily spend an entire workday responding to e-mail, answering the telephone, and dealing with the issues, queries, and crises that get walked through my office door every few minutes. I suspect I'm not the only one whose job is like that.

I bought my first PC almost 20 years ago specifically to help me "get organized." Dozens of machines and dozens of personal information managers later, I'm still waiting. Besides trying every PIM ever invented, I once took a day-long course in time management designed to help me get the most from my PC and PIM. The course unfortunately did little more than confirm what I had sensed for years: My work time *can't* be managed.

The very efficient instructor explained that the key to good time management is strict prioritization of all tasks: First do the tasks that are most closely aligned with your most important goals, then deal with the tasks that must get done that day to satisfy your job requirements, and so on. All well and good, I thought as I raised my hand to ask this question: "What about those tasks that others put on our list, those things that arise unexpectedly and absolutely must be dealt with that minute no matter what our life goals and daily priorities might be?"

"Oh, everyone has those unexpected tasks," she answered dismissively. "You just deal with them and get back to your daily plan," she said, turning back to her charts of metagoals and task-numbering schema. I soon slipped out the back door thinking to myself, "But dealing with those tasks is my daily plan. In fact, that's my life!"

I've been in management long enough to know that being available to my staff and dealing with the hourly exigencies of the workplace are big parts of doing my job right. More important, the truth is that if you find yourself in a similar situation, you *can* take comfort in the thought that you're not disorganized. **Consider yourself part of the new breed of knowledge worker.**

The research folks at the Gartner Group reported recently that by 2002 most jobs in most industries in this country will be devoted to this kind of knowledge work. Rather than being responsible for predetermined tasks, Gartner reported, the new knowledge worker is expected "to respond to events (issues, opportunities, or problems) within their domain by assembling relevant information, collaborating with others who share responsibility for or provide expert knowledge to the domain, and taking an action or making a decision."

Some may think this amounts to little more than the tendency to give highfalutin names to common tasks. Thus janitors become "facilities maintenance engineers" and every secretary is an "executive assistant." But I think the Gartner report is right on target. Today everyone's job is at least a little interrupt-driven. Ironically, the PC—thanks largely to e-mail—has just made things worse.

The quest to "get organized" has been a constant companion of personal computing. Consider that palm-size organizers continue to mushroom in popularity. And there are new PIMs every couple months. I'm on my fourth in three years. Heck, there are dozens available for free downloading from ZDNet's Hotfiles section.

In this new "react and act" world we'll need all the help we can get. I expect to be a lot better organized once my new Palm V arrives. If I can just get a little uninterrupted time to learn how to use it.



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Hard Drive	6GB hard drive* (removeable)	6GB hard drive* (removeable)	14GB hard drive* (removeable)
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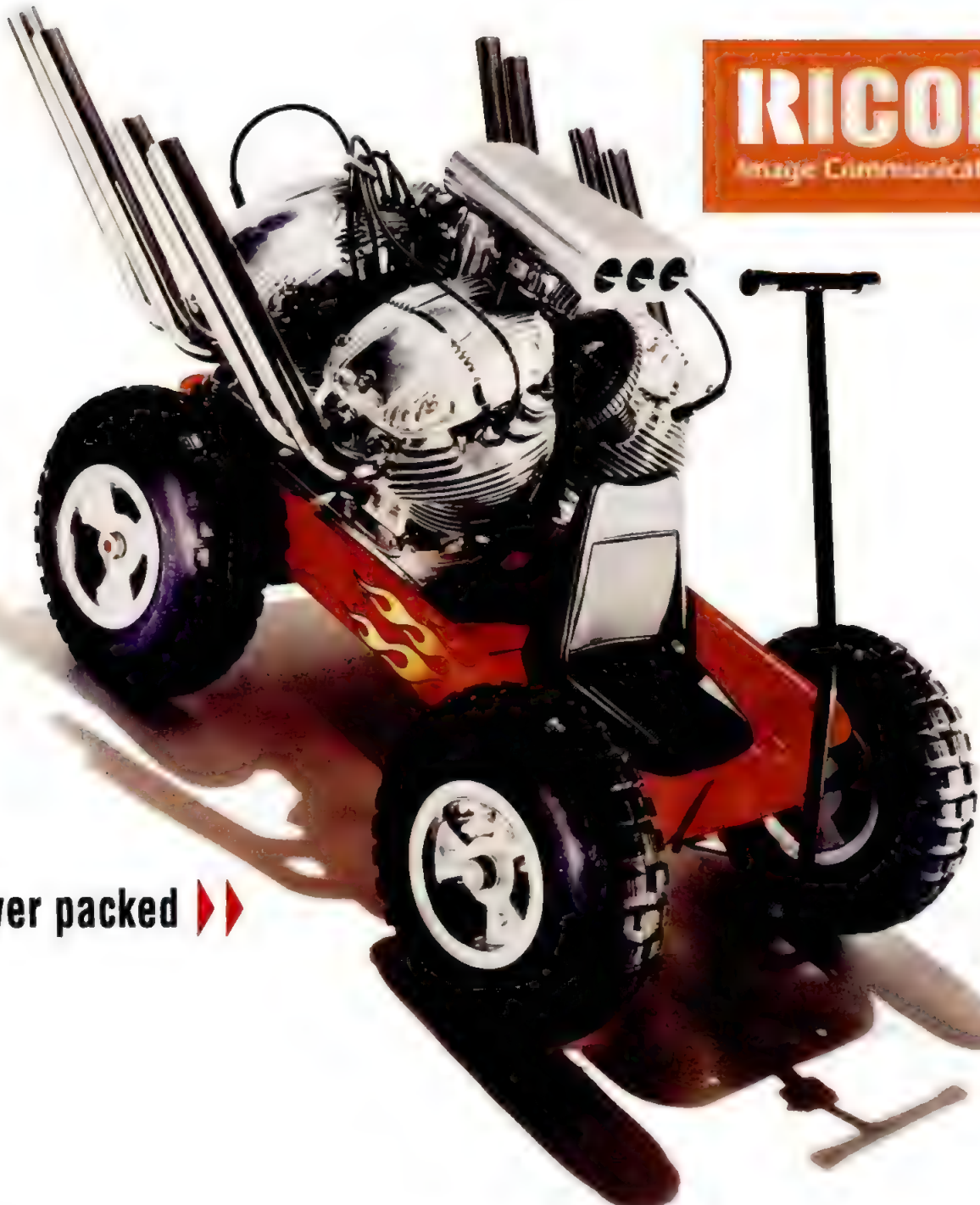


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Free PCs

Well, it was only a matter of time. PCs, available at absurdly low prices since the fall of 1997, can now be had for free—or at least nominally free. In February, the aptly named Free-PC promised free machines to 10,000 lucky applicants, reserving the right to post advertisements across nearly 40 percent of each system's display screen. Likewise, a company known as ZapMe! is supplying schools with free, though advertisement-laden, systems.

The latest trend has companies giving away PCs in much the same way cell phones were given away. You pay for the service—in this case, Internet access—and they throw in the hardware at no extra charge.

Here we compare and contrast two ostensibly free machines tied to Internet accounts: one from MyFreePC.com (not to be confused with Free-PC) and one from interSquid.com. To receive the interSquid system, you must typically commit to 30 months of Internet access at \$29.99 per month and pay an extra \$40 for a credit check, whereas MyFreePC.com asks that its \$529 fee—for setup and only 19 months of access—be prepaid. Similarly, three other companies (DirectWeb, Empire.net, and the Canadian enterprise OA Group) offer free systems if you sign up for three years of Internet access—a mere \$30 per month investment on average.

Free systems from interSquid and MyFreePC are hardly free and hardly extravagant, but they're relatively well built and capable of running most any mainstream application. All things considered, interSquid is a better option, offering a more flexible pricing plan, a better warranty, and generally more proficient hardware. Both are worth their minimal prices tags, however.

Core Hardware: We've yet to test these systems with our benchmark test suite, but the interSquid system is undoubtedly the faster

of the two, offering 32MB of SDRAM, the newish 333-MHz Celeron processor, and a Trident AGP card. The MyFreePC system also includes 32MB of memory, but uses a PCI graphics card and Intel's 233-MHz Pentium MMX chip, which debuted in early 1997 and is no longer in production. In terms of storage space, interSquid again has the edge, boasting 4.3GB to MyFreePC's 1GB. Each machine, however, includes a floppy disk drive, a CD-ROM drive, a 15-inch monitor, and a 56-Kbps modem.

Extra Hardware: Whereas the MyFreePC

is equipped with USB, serial, parallel, audio, and PS/2 ports. Because it uses a serial mouse and an old 9-pin DIN connector keyboard, both PS/2 ports are unused but no serial ports are available. Two PCI slots, two 3.5-inch drive bays, and two 5.25-inch bays are available as well. Though the MyFreePC has four open bus slots (one ISA and three PCI), it leaves only two drive bays unused.

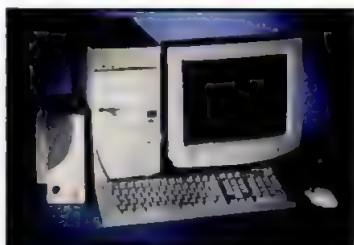
Internet Services: Both machines ship with software that easily puts you onto the Internet and provides unlimited access—which is, after all, the primary reason these machines exist.

The MyFreePC Internet wizard is pre-loaded, but the interSquid wizard is on CD-ROM.

Pricing: If you wish to pay for interSquid's requisite 30 months of Internet access by the month, you must pay \$40 for a credit check fee in addition to a \$29.99 monthly fee. With a credit card, you can alternatively pay for the entire 30 months up front and avoid extra charges. In each case, interSquid charges \$60 for shipping and handling. Before sending you a system, the less flexible MyFreePC.com requires you to pay a \$20 setup charge, a \$509 fee for 19 months of Internet access, and at least \$40 for shipping.

Of course, this comes to only \$569 in total, considerably less than the minimum \$959.70 you'll be paying with interSquid. With MyFreePC, you can pay by the month, but it involves a very high interest-bearing loan set up by a third party.

Name and Service: Some will be comforted that MyFreePC uses recognizable brand-name systems—the one we tested was a Packard Bell—while others will scoff at its 90-day limited warranty. Those with less money to spend up-front and less concern for Windows performance will prefer the MyFreePC, but others will be happier with the interSquid, which is backed by (remarkably) a three-year-parts, one-year-labor warranty. So what if *free PC* is a misnomer?—Cade Metz



I'M FREE: MyFreePC and interSquid sell you several months of Internet access, and the companies throw in a PC at no extra charge.

	interSquid www.intersquid.com	MyFreePC.com www.myfreepc.com	DirectWeb* www.directweb.com	Free-PC* www.free-pc.com
Minimum cost	\$29.99 per month	\$26.79 per month	\$19.95 per month	Free
Minimum specs	333-MHz PC, 32MB RAM, 4.3GB hard disk, 15-inch monitor, 56-Kbps modem	233-MHz PC, 32MB RAM, 1GB hard disk, 15-inch monitor, 56-Kbps modem	333-MHz PC, 64MB RAM, 6.4GB hard disk, 15-inch monitor, 56-Kbps modem	333-MHz PC, 32MB RAM, 4GB hard disk, 15-inch monitor, 33.6 Kbps modem
Vendor's share of PC real estate	None	None	1GB to 2GB of the hard disk	50% of the hard disk, 39% of the screen
Internet service	✓	✓	✓	✓
Customer-owned	✓	✓		✓
Customer-leased			✓	✓
On-screen ads			✓	✓
The catch	30-month commitment	19-month commitment	\$150 deposit (refundable after 12 months)	Minimum usage, 10 hours per month

* Not yet available at the time of our review

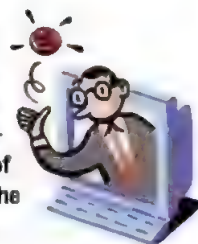
ships to customers with only the main system, a monitor, a mouse, and a keyboard, the interSquid system is generously accompanied by a pair of stereo speakers, a gooseneck microphone, a monitor filter, a palm rest, and several minor software packages. Of the latter, only Webster's International Encyclopedia is a recognizable title, but free software is always welcome.

Upgradability: Should you be unhappy with the hardware included with these free machines and wish to—with the money you're saving—add a few of your own peripherals, each PC includes some, but not ample, room for expansion. Built around a BabyAT motherboard, the interSquid system offers almost all of its external I/O through add-in cards, but

Small-Business Savings

By David Lidsky

The Web offers many opportunities to rethink some of the services that fuel your business—telephone, fax, package shipping, and office supplies—and develop new strategies or new suppliers that will help you be more efficient and save money. The businesses that learn to integrate the Web into even the most mundane of traditional business activities will be the big winners. Here are some of the best resources available to get the edge on your Luddite competitors.



Cut Shipping Costs

➤ When it absolutely, positively has to be there, you need to rely on shipping services, but choosing between the post office, Airborne Express, Federal Express, or UPS can be complicated when you're trying to save money every time. Both **iShip** (www.iship.com) and **SmartShip** (www.smartship.com) give you an easy way to make sure you pick the right package-delivery service for the job. Type in the origin and destination ZIP codes and the weight of your package and find out the prices for the four major services. Neither site is perfect: They both return slightly different prices, and neither can connect you directly to a shipping service. But iShip offers more flexibility and lets you set such variables as package insurance. It also has a slicker interface and promises to add more services soon, including paying for your shipping through its site and printing out shipping labels.

Throw Out Your Fax Machine

➤ E-mail should have killed off the fax, but if you still need to receive faxes, you don't necessarily have to get a second phone line and a fax machine to do so. Both **CallWave** (www.callwave.com) and **eFax** (www.efax.com) let you receive faxes free. Just sign up, give your e-mail address, and get a fax number. Any faxes sent to that number will show up in your e-mail in-box as an attachment. The high quality of the fax transmissions was impressive, but neither service distinguished itself. One thing that currently gives CallWave the nod over eFax is CallWave's use of Imaging for Windows, which almost all Windows 9x users will have, whereas eFax requires you to download a proprietary image viewer (less than 200K). Despite this minor drawback, eFax appears to be more aggressive in launching premium services, which let you send faxes

via e-mail, get a toll-free number, and archive old faxes.

Reduce Phone Bills

➤ No matter how virtual your company, you still need to have a phone. **TeleWorth** (www.teleworth.com) features a service called TeleRate for Small Business that lets you enter in your calling area, the rates you currently pay, and your average monthly number of outgoing, inbound toll-free, and calling-card calls to help you find the carrier that will save you the most money. TeleWorth pulls its data from 500 long-distance carriers. To find the best cellular plan for

more, and it will help you winnow down your choices. It offers helpful definitions of cellular jargon, and you can either find an area dealer or buy online, if that's possible.

Buy Office Supplies

➤ Keeping your office stocked with pens, printer paper, and other essential supplies can be time-consuming and expensive. The Web can help: The three major office-supplies superstores, Office Depot, OfficeMax, and Staples, all have e-commerce sites, and there's also a new start-up, **works.com** (www.works.com). All offer custom shopping lists and order histories. **Office Depot Online** (www.officedepot.com) is the only one that lets you pick up your order at a nearby store. Both **Staples.com** (www.staples.com) and **works.com** include an order approval process. But Staples.com offers the most bells and whistles, with e-mail notification services, the ability to customize the store to just those aisles you shop, and the largest selection of any of the sites. For your business correspondence needs, check out **iPrint.com** (www.iprint.com), where you can design and purchase letterhead, business cards, and notepads, as well as custom promotional items like mugs and T-shirts. PC

The screenshot shows the Wireless Dimension website. The main heading is "Find a Service Plan". Below it, there's a section titled "Answer any or all of the questions below to display just the plans that fit your needs. Click on the name of a plan at any time to see details, including coverage maps, available phones and special offers. To compare up to five plans at a time, use the 'side-by-side' tool." There's a dropdown menu for "Your current selected location is Washington, D.C. Click here to change it." Below that, there's a question "How much do you want to spend each month for wireless access? Access charges typically include some local calling minutes but don't include other fees you might voluntarily incur, such as long-distance tolls and specialized network service charges." with radio button options: "\$20 or less", "\$40 or less", "\$60 or less", "\$80 or less", "\$100 or less", and "No cost limit". On the right side, there's a sidebar with "Related Articles" including "Competition favors consumers" and "Glossary of billing terms". There's also a promotional banner for "The best way to buy cellular" with "\$25 off your next purchase".

your company, check out **Wireless Dimension** (www.wirelessdimension.com). It lets you compare service plans in more than 70 U.S. markets; select the price you want, the number of minutes you expect to use the phone each month, the technology you prefer, and

Use Wireless Dimension's excellent comparison site to cut through the hassle of selecting a cellular phone plan. Each time you select an option, the site automatically recalculates the number of plans that meet your needs.

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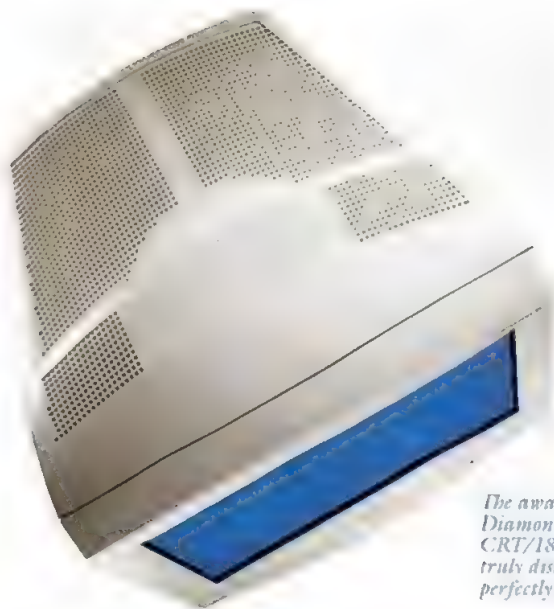


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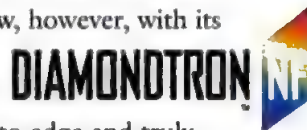
Diamond Pro 900u
March 1999



Diamond Pro 900u
February 1999

Throwing You A Curve?

If you're using a conventional CRT monitor, your eyes and brain are working overtime to correct for the curvature. Now, however, with its **DIAMONDTRON NF™** (Natural Flat) family, Mitsubishi has completely revolutionized monitor technology. With a perfectly flat screen from edge to edge and truly distortion-free imagery, you'll experience an unprecedented improvement in viewing pleasure. Not to mention the dazzling brightness, razor-sharp clarity and stunning color accuracy which puts Mitsubishi in a class by itself. With no curvature, reflections and glare are also eliminated. The result is remarkably realistic, natural-looking flat images. Your energy can now be spent being more creative and more productive. For added versatility,



DIAMONDTRON NF monitors feature a unique self-powered USB hub which allows you to switch all connected USB peripherals between two computers automatically. With **DIAMONDTRON NF** monitors, Mitsubishi will forever change your

view of the world. The difference is right before your eyes. For more information on the award-winning Diamond Pro 900u (19-inch CRT/18.0-inch DVI*) and new Diamond Pro 2020u (22-inch CRT/20-inch DVI*) models, contact Mitsubishi Electronics today.

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The Pentium III at 550

Intel's flagship CPU for power users gets a slight speed bump—but that's just part of the story for these machines.

By Carol Venezia

The 550-MHz Pentium III processor may go down in history as the only Intel CPU introduced without a direct focus on speed. Sure, it's fast—our ZD Business Winstone 99 test program pegs the part at about 6 percent faster on the average than the 500-MHz Pentium III on common applications. But throughout our testing for this story, we heard more about the services and features surrounding the processor than about how fast the PIII/550 churns bits and bytes. For system vendors, the focus has shifted from the speeds and feeds of the past to the “beyond the box” experience—particularly on the Internet—which is our future.

You might think that Intel would be upset about this: After all, the chip giant expends an incredible amount of resources on building fast CPUs. But you'll find that even Intel has changed its tune slightly from past messaging for the Pentium III generation. The major thrust behind the PIII is enabling a better Internet experience—with a fast processor but also with enhanced software and plug-ins designed to take advantage of the part's Streaming SIMD Extensions (SSE).

BETTING THE MOST OUT OF THE PIII

SSE provides an instruction set and microarchitectural extensions that boost performance of applications that use them,

specifically those that are floating-point-intensive. And our tests show that SSE does indeed work. Under Photoshop 5, we found that performance was 12 to 33 percent faster with SSE-enabled filters. Note that we tested Photoshop 5.0.2 with an SSE plug-in; you can download this plug-in from Adobe's Web site (www.adobe.com).

And there's more where that came from. Since its introduction, more than 250 SSE-enhanced applications have been released, including games and speech recognition applications, among many others. But the big focus of design efforts thus far seems to be in the area of online technologies. If you like to view streaming content on Web

sites—and of course, if you own a Pentium III—you should download RealNetworks' RealPlayer G2, Version 6.0.3 (www.real.com) or Microsoft Windows Media Player 4.0 (still in beta but downloadable from www.microsoft.com).

You'll also find that many other Internet-related favorites for both viewing and creating audio and video content have gotten a shot of SSE, including Macromedia's Flash and Shockwave (www.macromedia.com), the IPIX Viewer, Version 5.4 (www.ipix.com), and Headspace's Beatnik Player (www.headspace.com). If you have a Pentium III PC, the best place to go for news, tools, and information is Intel's WebOutfitter Service site (www.intelweboutfitter.com).

ROUND 'EM UP

For this roundup, we looked at Pentium III/550 machines from Compaq Computer Corp. (the Prosignia Desktop 330), Dell Computer Corp. (the Dimension XPS T550), and Micron Electronics (the Millennium MAX 550). Each came with 128MB of RAM, a 19-inch monitor, removable storage options, and a great sound system. Both the Compaq and Micron machines are outfitted with the small-business customer in mind, while the Dell system was built for the power home user.



GOOD NEWS FOR WIN CE H/PCs:

The sub-3-pound IBM WorkPad z50 should prove that the category is truly viable. *Page 49.*

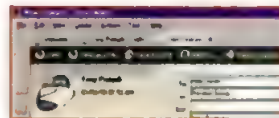
A BID FOR SUCCESS:

OpenSite Auction 4.0 helps you create an auction Web site with amazing speed and ease. *Page 64.*



TEAM PLAYER:

Lotus's Domino and Notes R5 join up to deliver corporate groupware and application development that's decidedly Internet-savvy. *Page 76.*



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More Reviews Online

- ART Recognition Professional Edition
- AAA Map 'n' Go 5.0
- Media Ring Talk 5.9



Read new reviews daily at
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FIRST LOOKS

We also received a machine from Gateway (configured with a PIII/500). The vendor withdrew from the roundup, however, because it was unable to provide us with a 550-MHz CPU in time for testing. By the time you read this, Gateway should have PIII/550 machines available.

The three PCs in our roundup have many common features: All use Diamond Viper V770 graphics cards based on nVidia's new RIVA TNT-2 chip set, 56K V.90 PCI modems, Creative Labs Sound Blaster Live! audio cards, and 7,200-rpm hard disks. That's why benchmark test scores were so close; Winstone, 3D WinMark, and CPUmark scores were virtually identical. The only real difference we saw was on our 3D WinMark test run at a 32-bit color depth. There the Compaq and Dell machines pulled ahead of the Micron unit by an average of about 12 percent (they had 32MB of memory, compared with the Millennia's 16MB).

But when it comes to services and support, our three contenders have gone a long way to add value to their machines. And we're talking more than just three-year warranties here:

You'll find that each vendor has added software, services, and programs designed specifically to enhance the value of the system for the customer who's going to purchase it.

Of the three, we found that

Compaq Prosignia Desktop 330

"What to feed a growing business" is Compaq's tagline for its Prosignia family of PCs. Judging from all the extras that come with

the systems—particularly, a great suite of online services geared toward small businesses—you'll con-

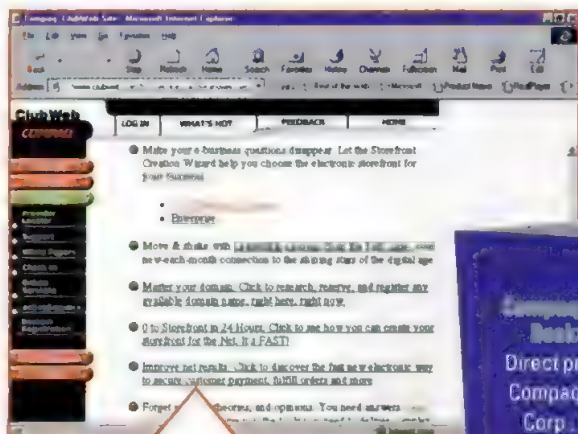
Services—a set of tools designed to help smaller businesses compete on equal footing with larger businesses, particularly online. The coolest service, if you're e-commerce-minded, is online .commerce, which comprises Compaq ezStore and the Compaq online.commerce suite.

Compaq ezStore is a wizard-driven Web site creation tool (INEX's ezStore Online Commerce), which you can use to set up a storefront online in just 20 minutes; listing 50 items costs

\$39.95 per month. The online.commerce suite includes Publisher (for creating an online catalog but without online ordering capabilities), Lite (orders can be placed online but are processed off-line), and Professional (for full-service sites). The first two options must be hosted by an ISP, but the latter can be hosted at your place of business.

Other Compaq Online Services include online.briefcase for remote access, online .postage for ordering postage over the Internet, and online .backup for backing up your company's data over the Internet, among others. Note that all of these services are fee-based: Compaq's value-add is giving you quick and easy access to them.

The Prosignia Desktop 330 itself is a mini-tower PC, which uses a chassis that can easily be converted into a desktop system in a matter of minutes. Our test machine came ready to do some serious business: Loaded up front, in addition to a 100MB Zip Drive, was a 52X TrueX CD-ROM drive, which uses Zen Research's Multibeam technology to deliver very fast sustained transfer rates. Our only issue with this case is that once you add the floppy disk drive, there's no room to add another front-accessible device (al-



JOIN THE CLUB:

Compaq's ClubWeb is check-full of information for Prosignia owners.



the Micron Millennia MAX 550 did the best job of meeting the needs of its target audience, so the unit receives our Editors' Choice award. But no matter which machine you choose, remember that it's not just about fast processors anymore. Look for the vendor that provides the services and support that you need, whether you're flying solo or running a small business.

clude as we did that the Prosignias make strong additions to any small business. Here we review the Compaq Prosignia Desktop 330 (\$2,799 direct), a machine that strikes a good balance among leading-edge peripherals, performance, and support.

The most attractive piece of the Compaq Prosignia Desktop 330 package is Compaq Online

BENCHMARK TESTS

High scores are best.

Bold type denotes first place

denotes Editors' Choice

	ZD Business Winstone 99	ZD 3D WinMark 99		ZD Business Graphics WinMark 99	ZD CPUmark 99
Compaq Prosignia Desktop 330	25.7	923	649	197	41.1
Dell Dimension XPS T550	25.6	930	673	195	41.0
Micron Millennia MAX 550	26.4	923	585	215	41.1
Average Pentium III/500*	24.7	685	N/A	177	38.4

* Pentium III/500: PC Magazine, March 23, 1999

N/A—Not applicable. We did not run 3D WinMark 99 on these units with these settings.

APPLICATION TESTS

Low scores are best.

	Adobe Photoshop 5		Twirl (15MB file)		Polar Coordinates (15MB file)	
	Non-SSE	SSE-enabled	Non-SSE	SSE-enabled	Non-SSE	SSE-enabled
Compaq Prosignia Desktop 330	6.8	4.8	8.4	5.9	17.0	15.0
Dell Dimension XPS T550	7.2	4.7	8.4	5.9	17.0	14.9
Micron Millennia MAX 550	6.3	4.4	8.4	5.8	16.9	14.8

though there was one free 3.5-inch internal drive in our test configuration).

On our benchmark tests, the unit kept pace with its competitors; there were no top scores, but all were within a few fairly negligible percentage points. Hardware elements contributing to this performance included the new Diamond 32MB Viper V770 graphics card and a 22GB, 7,200-rpm hard disk—the largest here.

We had mixed reactions to other hardware components. Although the included Compaq S900 monitor (with 0.22mm dot pitch) produced a stellar image and had great on-screen controls, the Altec Lansing ACS46 speakers weren't very loud and didn't produce good bass tones, despite the presence of a huge subwoofer. The Compaq unit scores on the software side, however, with Microsoft Office 2000 Small Business Edition.

If you want to purchase a PC that will help you move your business into the Internet era, the Compaq Prosignia Desktop 330 is a good pick.

Dell Dimension XPS T550

If great online support, easy Internet access, and leading-edge hardware are your hot buttons, the Dell Dimension XPS T550 (\$2,748 direct) is the machine for you. This system was crafted with the power home user in mind, and it's evident at every turn, from a fabulous speaker system and built-in 250MB Zip Drive (a Dell exclusive) to great 3-D graphics and 30 days of free Internet access, no credit card required.

Getting online doesn't get much easier than this: Through Dell's ConnectDirect service, just fill out a few screens worth of information and plug in a phone line, and you'll be taken directly to the Dell/Excite portal (and it knows your name when you arrive!). There, you can customize your home page to deliver the information you want.

Ask Dudley! is a nifty online support service for Dell customers. Just go to the support section of Dell's Web site and type in your question for Dud-

Editors' Choice

• Micron Millennia MAX 550



If this first look at Intel's new 550-MHz Pentium III processor

showed us one thing, it's that computing

has truly evolved into a complete, "out-of-box" experience. We no longer live by hardware alone: Now, it's what PC vendors wrap

around the hardware that makes or breaks a deal. And the machine that we feel will do the best job of meeting the needs of its target audience right out of the box is the \$2,899 (direct) Micron Millennia MAX 550, our Editors' Choice.

The MAX is an ideal machine for small businesses that want to compete head-to-head with the big boys—particularly online—but don't have the budget or dedicated IT staff to do the job. With services such as Ecommerce, Mconnect, and Micron U, you can get online and start doing business easily and quickly. And once you're there, you can train yourself or your staff to be more productive, to work more effectively, and even to jazz up your Web site; all of this is included with the purchase price.

And on the hardware side, you'll get an exceptionally powerful machine, complete with DVD, CD-RW, a Zip Drive, a big 18GB hard disk, and a 19-inch monitor. The Micron Millennia MAX 550 is more than just a PC—it's a sound investment for the future.

RIGHT AT HOME:
The Dell/Excite portal can be tailored to your preferences and offers quick links to Dell support.

Dell Dimension XPS T550
Direct price: \$2,748
Dell Computer Corp., Round Rock, TX; 800-999-3355
www.dell.com

ley, and you'll get instant answers. We asked numerous questions of the mythical Dudley (powered by Ask Jeeves technology), and we got the right answers back immediately, saving us from having to pick up the phone and call tech support.

Dudley is just the tip of the online support iceberg with Dell. You also get personalized system-support pages on which you key in your machine's service tag number. You're then plugged into all kinds of system-specific information, including drivers and self-diagnostic tools. You can also register online for Dell's

FileWatch service:

If there's an update to your computer's drivers, BIOS, or system files, you'll be notified via e-mail.

Dimension machines also have SnapRestore, a new preloaded application. This sim-

ple-to-understand program lets you back up the contents of your system's hard disk locally, so if disaster strikes, you can safely restore your data. And the process is relatively quick—we backed up our test machine in less than 7 minutes.

We were especially impressed with the Dimension's sound system. Audio is powered by Creative Labs' Sound Blaster Live! Value 512V PCI card, which is a dual-channel card (and exclusive to Dell). In addition to the standard jacks, there's a digital audio-out port, so you can hook up two sets of speakers if you wish. For speakers, the Dimension has the Altec Lansing ACS340 system with subwoofer; the right satellite has a headphone jack and bass, treble, and volume controls built into the base.

You won't find the Dimension lacking in internal hardware either. Its 32MB Diamond Viper V770 graphics card con-

FIRST LOOKS

tributed to top scores on our 3-D WinMark tests at both 16- and 32-bit color depths. Add to this a 6X DVD drive and a 19-inch Trinitron monitor, and you have a PC fit for a power user.

Dell's grade of A on our Service and Reliability survey reinforces the exceptional service message behind this PC. For a hassle-free computing experience, the Dell Dimension XPS T550 is an excellent choice.

Micron Millennia MAX 550



There's a new Micron machine on the block, and as the name

says, it certainly is the MAX. The Micron Millennia MAX 550 (\$2,899 direct) debuts a spacious new Micron case that not only gives you plenty of room to expand but also is easy to service—no tools required. But more than hardware makes the MAX our Editors' Choice in this roundup: The extra services and features tai-

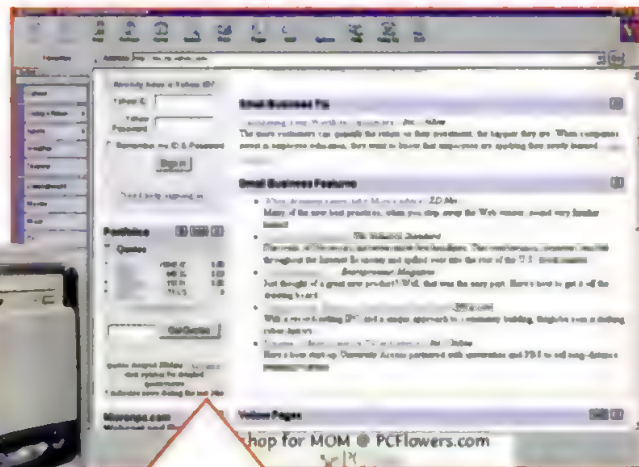
lored to you and your business make this PC a winner.

The metallic-silver-accented MAX is a few inches taller and wider than the average minitower, so you should plan on putting it underneath your desk rather than on top. But



Micron Millennia
MAX 550
Direct price: \$2,899.
Micron Electronics
Inc., Nampa, ID;
888-634-8799
www.micronpc.com

from the first time you boot up, you'll know that the extra real estate is worthwhile. At startup, you walk through a series of setup screens that help you register your machine and sign up for Internet access. Micron has teamed up with EarthLink and Yahoo! to deliver



PERSONALIZED:
You can set up your My Yahoo! home page before you connect for the first time.

customers to build an electronic storefront easily and to open for business quickly. A one-year contract with Virtual Spin includes credit card authorization services and complete purchase transaction handling; you pay Virtual Spin for the first six months and Micron picks up the fee tab for the next six months (up to \$3,000 per month).

Another great service for businesses or individuals is Micron University (a joint project with Microsoft and Ziff-Davis). With your Micron Millennia MAX 550 comes one year of free tuition to Micron U, so you can take Internet-based training courses, tutorials, and seminars. Classes are offered on just about every computing topic you can think of, from Visual Basic programming to how to repair your own PC.

Last but not least, Micron loaded some fabulous hardware into the MAX. In addition to an 18GB hard disk and a 16MB TNT-2-based Diamond Viper graphics card, there's a 6X DVD drive, a 100MB Zip Drive, and a CD-RW drive. Add great environmental sound from Creative Labs Sound Blaster Live! and Sonigistix Monsoon MM1000 flat-panel speakers, and you'll have a system that will knock your socks off.

If you want the most bang for your buck—and we don't mean just the hardware—the Micron Millennia MAX 550 is tough to beat. **PC**

SUMMARY OF FEATURES

550-MHz Pentium III PCs



	Compaq Prosignia Desktop 330	Dell Dimension XPS T550	Micron Millennia MAX 550
Direct price (with 128MB RAM)	\$2,799	\$2,748	\$2,899
Hard disk capacity	22GB	20GB	18GB
Graphics adapter/memory	Diamond Viper V770 / 32MB	Diamond Viper V7700 / 32MB	Diamond Viper V770 16MB
19-inch monitor	Compaq S900	Dell Trinitron P990	Micron 900LX
CD-ROM or DVD-ROM drive	52X True X CD-ROM	6X DVD-ROM	6X DVD-ROM
Extra mass storage	100MB Iomega Zip Drive	250MB Iomega Zip Drive	Sony 4X CD-RW
Sound	Creative Labs Sound Blaster Live!	Creative Labs Sound Blaster Live! Value 512V	Creative Labs Sound Blaster Live!
Speakers	Altec Lansing ACS46	Altec Lansing ACS340	Sonigistix Monsoon MM1000
Modem	Compaq V 90 PCI	3Com V 90	3Com V 90
Software included	Microsoft Office 2000 Small Business Edition	Microsoft Works Suite 99	Microsoft Office 2000 Small Business Edition

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SO WHAT IF WE'RE THE SMALL FISH IN THE BIG POND.



Piranha, pirat'i'ya, n. A small, voracious freshwater fish that will attack any sized opponent, no matter how large.

**We're not
the biggest,
so we have to
be the best.**

So, we're not the biggest - that means we try harder...we have to be the best. By offering the perfect **combination of service, quality and price**, you get the best hardware solution possible. **Personalized Service:** You will be assigned a SAG Integration Specialist who will be your single point of contact from pre- to post-sale. It's their job to know your system inside and out.

100% True Customization: Everybody claims to offer customized solutions, but our systems are truly built to order; you specify it, we build it. **Warranty & Support:** Our 3-year extensive warranty rivals the industry giants - plus you'll speak directly to our own on-staff tech advisors.

Leading Edge Technology: We are known for being first-to-market with the latest technology.

Best Price: Our prices continually beat our competition, see for yourself at sageelectronics.com.

Top Quality: We only use top-of-the-line components. That's why we've won so many awards. Here are just a few:





SAMPLE WORKSTATIONS

DUAL RAID 0-5 CUSTOMER

- (1) Intel Xeon PIII 550MHz Processor
- 512KB Cache, Expandable To 2 CPUs
- 256MB SDRAM Expandable to 2GB
- Slots: (6) PCI, (1) ISA, (1) AGP
- (2) IBM 9GB 10,000RPM LVD (15 Dms) 4MB Cache Removable HD
- AMI LVD Ultra2 Raid 0-5 Controller
- ES Galaxy 52MB Dual Port Video
- Sony 32X CD-ROM/Max
- Keyboard, Floppy, Mouse
- Full Tower 300 Watt

\$5330

SIN DUAL Xeon PIII 550MHz

- (1) Intel Xeon PIII 550MHz Processor
- 512KB Cache, Expandable To 2 CPUs
- 128MB SDRAM Expandable to 2GB
- Slots: (6) PCI, (1) ISA, (1) AGP
- Sound & Ethernet 10/100 by Intel
- Matrox G400 32MB 4X AGP Video
- IBM 756R 7200RPM IDE
- Sony 32X CD-ROM/Max
- Keyboard, Floppy, Mouse
- Full Tower 300 Watt

\$2779

SIN DUAL Xeon 400MHz

- Intel Pentium III Xeon 400MHz
- 512KB Cache
- 64MB SDRAM Expandable to 2GB
- Slots: (5) PCI, (2) ISA, (1) AGP
- 10GB 5400RPM IDE Drive
- Sony CD Recorder - Rewritable
- Matrox G200 16MB AGP Video
- Keyboard, Floppy, Mouse
- Mid Tower Chassis

\$1700

SIN DUAL PIII 500MHz

- (1) Intel Pentium III 500MHz Processor
- 512KB Cache, Upgr. To 2 CPUs
- 128MB SDRAM
- Slots: (5) PCI, (2) ISA, (1) AGP BX chipset
- IBM 10GB 7200RPM Ultra-33 Drive
- Sony DVD CD-ROM
- Soundblaster Live
- Subwoofer Speakers
- 16MB Diamond Viper 550 TNT Video
- Keyboard, Floppy, Mouse
- Mid Tower Chassis

2010

SIN CUSTOM 433

- Celeron 433MHz w/128KB Cache
- 32MB SDRAM
- Slots: (3) PCI, (3) ISA (1 shared), (1) AGP, 1X Chassis
- Integrated: PCI Soundblaster
- 8MB Invisio Video
- 10GB IDE Hard Drive
- Sony 32X CD-ROM/Max
- Keyboard, Floppy, Mouse
- Intel Landesk Management Software
- Desktop Chassis

772

SAMPLE SERVERS



Xeon QUAD RAID SERVER

- (1) Intel Xeon PIII 550MHz Processor
- 512KB Cache - Expandable to 4 CPUs
- 256MB ECC Memory, Expand to 4GB
- Slots: (7) PCI, (1) ISA • Integrated 2MB Video
- Integrated Dual Ultra 2 LVD SCSI Controllers
- 3 Chan. Ultra 2 LVD RAID Contr. w/64MB Cache
- (3) 36GB LVD 7200RPM Remov HD
- Intel Server Adaptor
- Server Management System On-board
- 32X CDROM/Max • Keyboard, Floppy
- 9 Drive Bay G-16 230 Watt Redundant Power Supplies

\$10,921 WEB CODE: S100

2U BACKUPUNIT PIII 550MHz

- (1) Intel PIII 550MHz Processor
- 512KB Cache - Expandable to 2 CPUs
- 128MB ECC Memory, Expand to 2GB
- Slots: (5) PCI, (1) ISA (1) AGP
- 8 MB AGP Video
- Intel Server Adaptor
- Integrated Adapter Ultra 2 LVD SCSI Controller
- 9GB LVD 7200RPM HD
- 32X CDROM/Max, Keyboard, Floppy
- 2U Rackmount 300 Watt Power Supply

\$3042 WEB CODE: S101

Xeon 550MHz RAID 5 SERVER

- (1) Intel Xeon PIII 550MHz Processor
- 512KB Cache - Expandable to 2 CPUs
- 256MB ECC Memory, Expand to 2GB
- Slots: (6) PCI, (1) ISA (1) AGP
- Matrox G200 8 MB AGP Video
- Integrated Intel 10/100 Ethernet
- 3 Channel LVD RAID 5 Contr. w/16MB Cache
- (3) 9GB LVD 10,000RPM 5 (15 Dms) Remov HD
- 32X CDROM/Max, Keyboard, Floppy
- 13 Bay Tower Chassis 400 Watt Redundant, Hot Swap Power

\$6823 WEB CODE: S102

SIN DUAL PIII 500 RAID 0-5

- (1) Intel Pentium III 500MHz Processor
- 512KB Cache, Expandable to 2 CPUs
- 128MB ECC Memory, Expandable to 1GB
- Slots: (4) 32 Bit PCI, (2) 64 Bit PCI GX Chipset
- Dual PCI Buses (64MHz PCI Support)
- Integrated Adapter Ultra2 LVD SCSI
- Integrated 10/100 Ethernet
- Integrated 2MB Video
- (3) 9GB LVD 7200RPM Remov HD
- 1 Channel LVD RAID
- Sony 32X CD-ROM/Max
- Keyboard, Floppy, Mouse
- Full Tower 300 Watt
- Intel Server Control Manager Software

2925 WEB CODE: S103

SAMPLE RAID SUBSYSTEMS



STC 10 BAY

- 2 Channel RAID LVD U2W Controller
- 10 Hot-Swappable Drive Bays
- Redundant Power Supplies
- 16MB Cache
- Internal Temperature Status
- Power Supply Status
- Cooling Fan Status
- Visual and Audible Alarm

Q: (3) 36GB 7200RPM LVD HD **\$8825**

Q: (3) 18GB 10,000RPM 15 Dms LVD HD **\$7928**

Q: (3) 9GB 10,000RPM 15 Dms LVD HD **\$6458**

STC 20 BAY

- Active/Active Controllers
- Q: (2) 4 Channel RAID 5 U2W Controllers
- 8 - 230 Watt Hot Redundant Power Supplies
- 128MB of Cache
- Internal Temperature Status
- Power Supply Status
- Cooling Fan Status
- Visual and Audible Alarm

72GB Solution

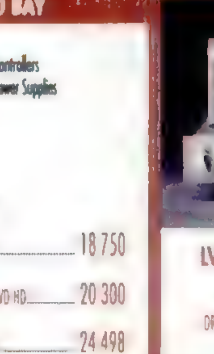
Q: (8) 9 1GB 7200RPM LVD HD **18 750**

72GB Solution

Q: (8) 9GB 10,000RPM 15 Dms LVD HD **20 300**

144GB Solution

Q: (8) 18GB 10,000RPM LVD HD **24 498**



LVD STORAGE SOLUTIONS

- Removable Drives
- Redundant Power Supplies

DRIVE OPTIONS:

- 36GB 18GB 9GB LVD SCSI Drives



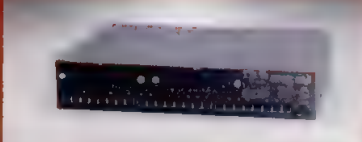
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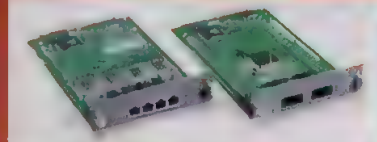
NETWORKING



Pro 100 LAN Adaptors



Gigabit Pro 1000 Adaptors



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Switches

Routers

Some options available. Returns may be subject to restrictions. RMA # must be acquired. Some choices have not been approved by the Federal Communications Commission. GSA # 44-11-65-245-3100. These choices are not, and may not be, offered for sale to the public, or sold or leased with the approval of the FCC. See below details.

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ELECTRONICS

Agile Acrobat

Adobe Acrobat 4.0 delivers new functionality that makes true document collaboration possible.

By Luisa Simone

Previous versions of Adobe Acrobat's Portable Document Format (PDF) let users create high-fidelity electronic documents that could be viewed on screen or printed locally. Acrobat 4.0 adds a full range of editing, annotation, and security functions that give users the ability not only to share documents but truly to col-

laborate on documents.

with a note field, so you can add explanations to your markups. Two of the more advanced annotation tools give you the ability to record a voice comment and to insert a native application file. You can, for example, embed a spreadsheet

Acrobat 4.0 takes advantage of this by letting you insert, extract, rearrange, rotate, and even renumber the pages in a PDF file.

Digital signatures provide a new level of security. Acrobat ships with Self-Sign Signatures, a technology that lets users create their own digital IDs. But plug-in technology lets third-party vendors insert and authenticate signatures using public-key encryption. Each time someone applies

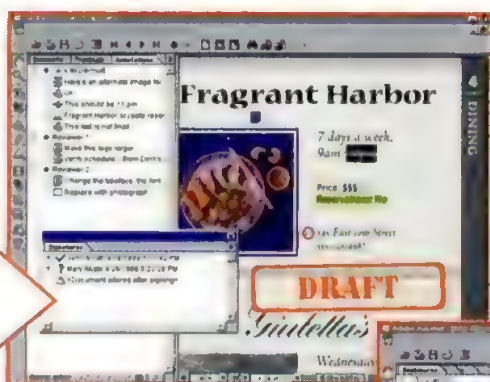
and provide a higher degree of fidelity when printing to paper. Acrobat maintains all of the hyperlinks in a converted document, so you can easily follow a link—either by invoking your Web browser or by capturing additional pages within Acrobat.

During testing, we discovered only minor inconsistencies. For example, the convenience of the PDFWriter (which lets you "print" a PDF file to disk as though you were printing to paper from any Windows application) is offset by its inability to process EPS images. You also get different results depending upon whether you drag an image file into an open Acrobat document (appended as a new page) or a word processing file (generated as a new, separate document).

Surprisingly, two of the new features, Signatures and Web Capture, are available only in the Windows version of the product. Adobe plans to deliver these features to Mac users as an update but has not announced a release date.

Many of Acrobat 4.0's functions were previously

TAKE NOTE: Acrobat 4.0 can annotate a document with sticky notes, highlighted or strike-through text, and stamps.



laborate on documents.

The sheer number of new features in Acrobat is evidenced by the interface changes, which include a fully populated toolbar and a number of tabbed, dockable palettes. Acrobat also lets you zoom and pan the current page using a Navigator tool similar to the one found in Photoshop.

Acrobat 3's annotation method—electronic sticky notes—is notoriously limited: The notes don't easily identify the author of a comment, can't point to specific objects on a page, and contain only unformatted text. But all that changes with Acrobat 4.0. The new Annotations palette lists every comment in an outline format that can be sorted (by criteria such as author or date) or used to navigate the document.

In addition to using the ubiquitous sticky notes, you can now highlight or strike through text and draw directly on the page. You can even stamp a page with standard messages such as Approved and Confidential. Each of these objects is associated

file into a PDF document to provide live formulas along with a financial report.

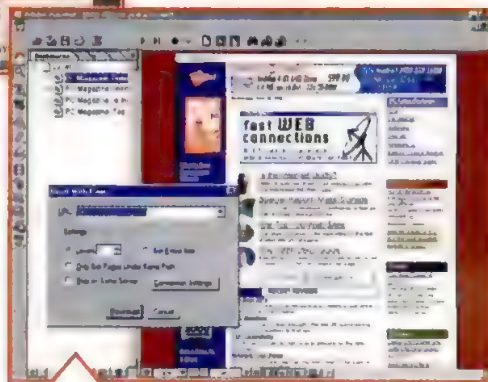
Acrobat 4.0 does not offer robust editing tools. But simple text corrections—meaning ones that don't force new line breaks—are now possible. This seemingly small feature can have big payback in a prepress workflow, because users can fix the inevitable typos without having to regenerate an entire PDF file.

Users who distribute information via PDF files will be happy to hear that they can copy entire paragraphs, true tables, and images to the Clipboard for use in other programs. We found the implementation awkward, in that it requires you to switch between several different specialized selection tools, but we appreciate that we no longer have to rekey data.

Unlike in PostScript, which treats a multipage document as a continuous data stream, Adobe's PDF files contain discrete pages.

a digital signature to a PDF file, Acrobat saves the current version of the document.

Acrobat 4.0 makes creating PDF files easier than ever before. You can now drag files from Explorer into an open Acrobat window to invoke background



CATCH THE WEB: Acrobat 4.0 can now capture HTML pages, even an entire Web site, directly from the Web.

processing. Office 97 users will find that Acrobat inserts both a command and a toolbar button that let them output PDF directly from Microsoft Excel, Power-

Point (but not Access), and Word. If you opt to use Distiller (rather than the simpler PDFWriter), macros let you convert many of Word's advanced functions (such as text frames, cross references, and heading levels) into PDF equivalents (such as article threads, links, and bookmarks).

Finally, you can use the new Web Capture command to convert HTML pages into PDF files. The PDFs can be read off-line

available as third-party plug-ins. For example, the annotation tools are licensed from Ambia Remark, and the formatted text selection tool was developed by BCL Computers. Their inclusion in the core feature set makes Adobe Acrobat 4.0 an invaluable tool for a wide range of publishing applications—including workgroup collaboration and print production workflow.

Adobe Acrobat 4.0. Street price: \$250; upgrade, \$100. Requires: 16MB RAM for Microsoft Windows 95 and 98, 24MB RAM for Windows NT; 75MB hard disk space; Windows 95, 98, or NT 4.0 with Service Pack 3 or later. Adobe Systems Inc., San Jose, CA; 800-272-3623; www.adobe.com.

8% of you work in the IT department.

76% of you don't even know what "IT" stands for.



Whether you're an Information Technology guru or a first-time user, we'll build you the right PC.





The Gateway® Essential Line: high-performing computers without the high-ticket price.

Gateway Essential PCs, for users who want a powerful computer that's affordable but doesn't skimp on the stuff you need. Loaded with Intel® processors and plenty of memory, they're perfect for families, students or first-time buyers. And since they're not fattened up with unnecessary extras, the prices are nice and lean.

GATEWAY ESSENTIAL 400c

- Intel® Celeron™ Processor 400MHz with 128K Cache
- 64MB SDRAM
- EV600 15" Monitor (13.9" viewable)
- 8MB AGP Graphics
- 4.3GB Ultra ATA Hard Drive
- SoundBlaster® AudioPCI™ 64D
- GCS-200 Speakers by Cambridge® SoundWorks
- 56K¹ Internet/Fax Modem
- Microsoft® Windows® 98
- Corel® WordPerfect® Suite 8 Software

\$999 or as low as **\$28/mo.** for 48 mos.²
through our Your:)Ware™ program⁴

GATEWAY ESSENTIAL 433c

- Intel Celeron Processor 433MHz with 128K Cache
- 64MB SDRAM
- EV700 17" Monitor (15.9" viewable)
- 8MB AGP Graphics
- 8.4GB Ultra ATA Hard Drive
- SoundBlaster AudioPCI 64D
- GCS-200 Speakers by Cambridge SoundWorks
- 56K¹ Internet/Fax Modem
- Microsoft Windows 98
- Corel WordPerfect Suite 8 Software
- **1-Year gateway.net™ Internet Access³**

\$1299 or as low as **\$37/mo.** for 48 mos.²
through our Your:)Ware program⁴

GATEWAY ESSENTIAL 466c

- Intel Celeron Processor 466MHz with 128K Cache
- 64MB SDRAM
- EV700 17" Monitor (15.9" viewable)
- 8MB AGP Graphics
- 8.4GB Ultra ATA Hard Drive
- SoundBlaster AudioPCI 64D
- GCS-200 Speakers by Cambridge SoundWorks
- 56K¹ Internet/Fax Modem
- **Canon® Color Printer**
- Microsoft Windows 98
- Corel WordPerfect Suite 8 Software
- **1-Year gateway.net Internet Access³**

\$1499 or as low as **\$42/mo.** for 48 mos.²
through our Your:)Ware program⁴

All Gateway Essential PCs include: 32X Max Variable CD-ROM®, 3.5" Diskette Drive, Micro-Tower Case, MultiFunction Keyboard, Mouse, HelpSpot™ Troubleshooting & Self-Repair Software, Year 2000 Compliance®, 1-Year Parts & Labor/1-Year On-Site Support.⁷

Choose any Gateway Essential or Gateway Performance PC, and you can customize it with one of the following solution packages:

Family Entertainment Package - \$149

- kidBoard™ Sketchboard™ Drawing Tablet
- Hasbro Interactive™ Classic Games (Sorry!®, Pictionary®, Scrabble®, Boggle®, Ultimate Yahtzee®)

KidBuilder Start-Up Package - \$199

- KidBuilder Preschool-Kindergarten Software (includes 7 titles)
- kidBoard Keyboard
- kidBoard Sketchboard Drawing Tablet

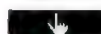
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pentium III



The Gateway™ Performance Line: no-holds-barred computers with nothing but the best inside.

Some people want their computer to be the ultimate. That's where Gateway Performance PCs come in. They're fixed up with only choice components from renowned manufacturers, with fast speeds and serious RAM and drive space. Plus, they've got the goods for graphics and audio, all in the name of the insane multimedia experience.

GATEWAY PERFORMANCE 450

- Intel® Pentium® III Processor 450MHz with 512K Cache
- 64MB SDRAM
- EV700 .28 Screen Pitch 17" Monitor (15.9" viewable)
- 16MB NVIDIA® RIVA TNT™ AGP Graphics
- 9GB Ultra ATA 66 7200 RPM Hard Drive
- 6X DVD-ROM Drive & MPEG2 Decoder
- SoundBlaster® AudioPCI™ 64D
- Boston Acoustics® BA735™ Digital Speakers w/Subwoofer
- U.S. Robotics® 56K Voice Winmodem*
- 8-Bay Mid-Tower Case
- Microsoft® Windows® 98
- MS® Works Suite 99 Software
- 3-Year Parts & Labor, 1-Year On-Site Support†
- Year 2000 Compliant*

\$1599 or as low as **\$45/mo.** for 48 mos.†
through our Your:Ware™ program*

GATEWAY PERFORMANCE 500

- Intel Pentium III Processor 500MHz with 512K Cache
- 64MB SDRAM
- EV700 .28 Screen Pitch 17" Monitor (15.9" viewable)
- 16MB NVIDIA RIVA TNT AGP Graphics
- 13.5GB Ultra ATA 66 7200 RPM Hard Drive
- 6X DVD-ROM Drive & MPEG2 Decoder
- SoundBlaster AudioPCI 64D
- Boston Acoustics BA735 Digital Speakers w/Subwoofer
- U.S. Robotics 56K Voice Winmodem
- 8-Bay Mid-Tower Case
- Microsoft Windows 98
- MS Works Suite 99 Software
- 3-Year Parts & Labor, 1-Year On-Site Support†
- Year 2000 Compliant*

\$1999 or as low as **\$56/mo.** for 48 mos.†
through our Your:Ware program*

GATEWAY PERFORMANCE 550XL

- Intel® Pentium® III Xeon™ Processor 550MHz with 512K Cache
- 128MB SDRAM
- VX900 .26 Screen Pitch 19" Monitor (18" viewable)
- 16MB NVIDIA RIVA TNT AGP Graphics
- TV/FM Tuner Card
- 18GB Ultra ATA 66 7200 RPM Hard Drive
- 6X DVD-ROM Drive & MPEG2 Decoder
- Philips® CD-RW (CD-Rewritable) Drive
- SoundBlaster AudioPCI 64D
- Boston Acoustics Digital MediaTheater™ Dolby® Digital 3-Piece Speaker System
- U.S. Robotics 56K PCI Voice Winmodem
- Easy Share Home Networking Ready
- 10-Bay Tower Case with 300-Watt Power Supply
- Microsoft Windows 98
- MS Office 97, Small Business Edition plus Bookshelf® 98 & FREE Office 2000 Upgrade Offer†
- 3-Year Parts & Labor, 1-Year On-Site Support†
- Year 2000 Compliant*

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through our Your:Ware program*

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Choose any Gateway Essential or Gateway Performance PC, and you can customize it with one of the following solution packages:

Complete Gamers Package - \$149 (Content suitable for ages 17 and older)

- Extreme Gaming Software (Hexen II™, Heavy Gear™, Quake II™, Battlezone™)
- Extreme Gaming II Software (Unreal™, Forsaken™, The House of The Dead™, Turok® Dinosaur Hunter)
- Microsoft SideWinder® Precision Pro Joystick

Easy Share Home Networking Packages:

- 1 PCI Card (for 1 PC) - **\$79**
- 2 PCI Cards (for 2 PCs) - **\$149**

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Gateway™ ALR® 7200 Workgroup Server

Gateway Solo® 3150 Portable PC

High performance equipment with the flexibility to work the way you do.

Power meets expandability: this affordable server offers up speed while allowing room to grow when your business does.

- Intel® Pentium® II Processor 350MHz
- 64MB 100MHz ECC SDRAM (upgradeable to 1GB)
- Dual-Channel PCI Ultra2 SCSI w/two Adaptec AIC7890s
- Integrated PCI Graphics with 2MB SDRAM
- 4GB Ultra2 LVD SCSI 7200RPM Hard Drive
- Integrated Intel PCI 10/100 Twisted Pair Ethernet
- 13X min/32X max IDE CD-ROM Drive
- 104+ Keyboard
- PS/2 Compatible Mouse
- InforManager™ Server Management Software
- 3-Year Parts & On-Site Service Limited Warranty, 30-Day Network Operating System Support¹

**\$1840 or \$63/mo.
for 36 mos. lease²**

Ad Code # 11090



Portable to the extreme: at 5 pounds and 1.2 inches tall, it's great for people on the move who want to work hard but pack light.

- 12.1" TFT Color Display
- Intel Celeron™ Processor 300MHz (expandable to Pentium II Processor 366MHz)
- 32MB SDRAM (expandable to 160MB)
- 2.5MB Video Memory w/256 Bit Graphics Accelerator
- 10X min/24 max CD-ROM Drive (or DVD-II Drive)
- Integrated V.90³ Modem
- Integrated 3Com® 10/100 Ethernet
- EZ Point® Pointing Device
- 4GB Ultra ATA Hard Drive (expandable to 6GB)
- Microsoft® Windows® 95, Windows 98 or Optional Windows NT® 4.0
- Optional MS® Office 97, Small Business Edition plus Bookshelf® 98 or MS Office Professional
- 3-Year Limited Warranty¹

**\$2099 or \$72/mo.
for 36 mos. lease²**

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Gateway® Business Computers

Gateway designs computers for businesses of all sizes and functions.

ALR Series Servers



ALR 8200 Departmental Server

Enough power for mid-sized business and seriously scalable.

- Intel Pentium II Processor 350MHz with 512K Cache (Dual Pentium II & Pentium III Processor capable)
- 128MB PC 100 ECC SDRAM (expandable to 1GB)
- 9GB Ultra 2 SCSI Hard Drive (expandable to 324GB)
- Integrated Intel 10/100 Ethernet
- InformManager Server Management Software

Starting at **\$3699** or **\$126/mo.**
for 36 mos. lease²



ALR 9200 Enterprise-Class Server

Rapid data flow with the power of up to 4 processors.

- Intel® Pentium® II Xeon™ Processor 400MHz with 512K Cache (Quad Pentium II Xeon & Pentium III Processor capable)
- 256MB ECC 100 ECC EDO DRAM (expandable to 4GB)
- 4GB Ultra 2 SCSI Hard Drive (expandable to 54GB)
- 10-Bay Tower Case with Dual 400W Hot Swap Power Supplies (optional N+1 Power Supply Subsystem)
- Gateway Server Management Software
- FCC Class A¹

Starting at **\$7999** or **\$244/mo.**
for 36 mos. lease²

GP/E-Series Business Desktop PCs



GP-Series Small Business Desktops

Network-ready and ready to work.

- Intel Celeron Processor 366MHz with 128K Cache (up to Pentium III Processor 500MHz)
- 64MB SDRAM (expandable to 384MB)
- 6.4GB Ultra ATA Hard Drive (expandable to 22GB)
- 10/100 Twisted Pair Ethernet
- EV500 15" Color Monitor (13.9" viewable)
- Microsoft Windows 95 or Windows 98
- MS Office 97, Small Business Edition plus Bookshelf 98

Starting at **\$1299** or **\$45/mo.**
for 36 mos. lease²



E-Series Managed Desktop PCs

Serviceable, reliable and manageable.

- Intel Celeron Processor 366MHz with 128K Full-Speed Cache (up to Pentium III Processor 500MHz)
- 32MB SDRAM (expandable to 384MB)
- 4.3GB S.M.A.R.T.™ II Ultra ATA Hard Drive (expandable to 22GB)
- 10/100 Ethernet with Wake-up On LAN
- EV500 15" Color Monitor (13.9" viewable)
- Intel LANDesk® Client Manager v.3.31

Starting at **\$999** or **\$34/mo.**
for 36 mos. lease²



E-Series Technical Workstations

Perfect for high-tech applications.

- Intel Pentium II Processor 350MHz with 512K ECC Cache (up to Pentium® III Xeon™ Processor 500MHz)
- 64MB ECC SDRAM (expandable to 2GB)
- 4.3GB S.M.A.R.T. II Ultra ATA Hard Drive (expandable to 22GB IDE)
- 3Com 10/100 Ethernet with Wake-up On LAN
- VX900 19" Color Monitor (18" viewable)
- Microsoft Windows NT 4.0

Starting at **\$1999** or **\$68/mo.**
for 36 mos. lease²

Solo® Portable PCs



SOLO 2500

A solid, affordable portable with all you need inside.

- 12.1" TFT Color Display (expandable to 13.3")
- Intel Celeron Processor 300MHz (up to Pentium II Processor 366MHz)
- 32MB SDRAM (expandable to 256MB)
- 4GB Ultra ATA Hard Drive (expandable to 10GB)
- Microsoft Windows 95, Windows 98 or Optional Windows NT 4.0
- Optional MS Office 97, Small Business Edition plus Bookshelf 98 or MS Office Professional

Starting at **\$1599** or **\$55/mo.**
for 36 mos. lease²



SOLO 5150

The presentation portable: a big screen in a small package.

- 14.1" TFT Color Display
- Intel Pentium II Processor 300MHz (up to Pentium II Processor 366MHz)
- 32MB SDRAM (expandable to 256MB)
- 4GB Ultra ATA Hard Drive (expandable to 10GB)
- Microsoft Windows 95, Windows 98 or Optional Windows NT 4.0
- Optional MS Office 97, Small Business Edition plus Bookshelf 98 or MS Office Professional

Starting at **\$2099** or **\$72/mo.**
for 36 mos. lease²



SOLO 9150

The powerhouse with a huge screen—like a desktop PC you can carry.

- 15" TFT Color Display
- Intel Pentium II Processor 300MHz (up to Pentium II Processor 366MHz)
- 64MB SDRAM (expandable to 384MB)
- 4GB Ultra ATA Hard Drive (expandable to 14GB)
- Microsoft Windows 95, Windows 98 or Optional Windows NT 4.0
- Optional MS Office 97, Small Business Edition plus Bookshelf 98 or MS Office Professional
- 3-Year Limited Warranty¹

Starting at **\$2649** or **\$91/mo.**
for 36 mos. lease²

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IBM's Winning Jupiter H/PC

The IBM WorkPad z50 may breathe new life into the Windows CE H/PC Pro market.

By Carol Venezia

Since a quiet introduction last fall, there hasn't been much excitement in the Windows CE hand-held PC professional (aka "Jupiter" or H/PC Pro) market. But the IBM WorkPad z50 (\$1,000 street) may change all that. This sub-3-pound device should do for the H/PC market what many an IBM ThinkPad has done: prove that the category is indeed viable.

The 1- by 10.2- by 8-inch (HWD) WorkPad z50 is the first Jupiter device aimed at the corporate market that solves the connectivity problem. The issue that some companies have had with Windows CE is that it does not integrate easily with the existing infrastructure unless the back end runs on Microsoft software.

With the preinstalled Mobile Connect client, your WorkPad z50 can connect directly to server-based information, including Microsoft Mail and Exchange, Lotus Notes mail and calendaring, and various databases. To connect our test machine, we ran through a series of simple setup screens, and we were synchronizing e-mail, calendar, contacts, and tasks within minutes.

The WorkPad z50 is also the most full-featured Jupiter machine we've seen. It's the only one that can take a Type III PC Card: Just remove a small door on the left side of the machine that's covering what appears to be a Type I slot, and voilà! You'll find two stacked slots.

The WorkPad z50 also has a great keyboard—which is not surprising, given that its ThinkPad cousins tout the best keyboards in the market. This keyboard is almost full size, at 95 percent, and has an 18mm key pitch. The layout is just like a traditional notebook keyboard's, and you'll find the familiar TrackPoint key is nestled between the

G and H keys. We found typing was easy. There are also 12 dedicated application-launch keys.

Memory is another area in which the WorkPad z50 excels. It has 20MB of ROM, up to 48MB of RAM, and 4MB of VRAM; so its 8.2-inch VGA dual-scan screen can display 64K colors. You'll also find a CompactFlash slot, a video-out port, a Fast IR transceiver, an RJ-11 jack for the built-in 33.6-Kbps modem, audio and micro-

TAP AWAY: Typing on the IBM WorkPad z50 involves none of the compromises usually encountered on small keyboards.

phone jacks, and a switch built into the display hinge that turns on the voice recorder even when the unit is closed.

The WorkPad z50 comes with the usual array of Microsoft Pocket applications, as well as bPrint, bFaxPro, and bUseful Backup. You can also get an optional high-capacity lithium battery, which doubles the standard 8 hours of battery life.

For corporate customers who

want Windows CE devices that integrate easily into their existing infrastructure, the IBM WorkPad z50 is in a class by itself.

IBM WorkPad z50. Street price: \$1,000. IBM Corp., Armonk, NY; 800-426-7255; www.ibm.com/pc/us/thinkpad.



Lock Up Your Laptop

The IBM SmartCard Security Kit protects your notebook from prying eyes and sticky fingers.

By Asa Somers

Chances are your company will soon suffer some sort of computer security breach, if this hasn't already. So if the choice is either potentially expose your company to information theft or shell out \$200 (street) for the new IBM SmartCard Security Kit, odds are your IT manager will opt for the latter.

Designed both to block unauthorized access to your sensitive data and to deter anyone from walking off with your laptop, the Security Kit will appeal to corporate customers because it provides a hardware-based level of security that cannot be compromised in the same way that a simple password can. The kit comprises a digital smart card (which serves as an individual's hardware "key"), a smart-card reader that plugs into a standard PC Card slot, and a CD-ROM of software (including Norton AntiVirus).

Installing the Security Kit is

like following a recipe for hollandaise sauce: You must follow a number of steps in order, but you'll be surprised at how easy it is. Your notebook must let you use the floppy disk drive and CD-ROM drive simultaneously, though, or you'll have to make a series of floppy disks from the CD-ROM and

then install the software.

Most users will immediately invoke the Security Kit's secure-screen-saver option, which kicks in when you leave your desk and prevents anyone but you from seeing your Windows desktop. Unauthorized use of your system is simply out of the question.

The Security Kit also provides a number of data-encryption options. You can specify that a par-

ticular file can be decrypted only when presented with your hardware key and PIN, which ensures the file will be seen only by you. Files encrypted with a common passphrase can be shared with other Security Kit users, and they can decrypt the files by presenting their smart cards to the system and entering the same passphrase.

You can also encrypt entire directories and specify folders that will automatically encrypt any file you create or place inside them. And users who do not have Security Kit software running on their systems can easily decrypt a self-extracting file you send by presenting a passphrase you have provided in advance.

The Security Kit is scalable when used in conjunction with Security Dynamics software, letting corporations specify access privileges to particular network directories for each user. Moreover, the Security Kit also supports Digital Signature, which allows secure access to a growing number of compatible Web sites. Future versions of the product will include Windows NT support and multiuser access to a single machine.

IBM SmartCard Security Kit. Street price: \$200. IBM Corp., Research Triangle Park, NC; 800-426-7255, ext. 4753; www.ibm.com/pc/us/accessories.



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The Streaming Media War

Windows Media Technologies aims to leapfrog Real Networks' products—for free.

By Jan Ozer

Microsoft's beta release of Windows Media Technologies 4.0 (née NetShow) makes it clear that the gloves are now off in the streaming media arena. The company has made some Texas-size claims about format superiority over RealNetworks and MP3 audio and has added aggressive new features to its product that target the downloadable music market. WMT offers free players for all and free servers for Windows NT server owners.

We found great improvements in audio quality with this release. WMT bested Real's G2 at 28.8- and 56-Kbps bandwidths. Direct comparisons of video are more complicated, but Microsoft's quality still lags behind G2.

Though format quality is the most noticeable characteristic of streaming media technology, three other

and two speech tracks, one noisy track taped at a conference and the other a pristine clip produced in a studio.

To compare quality at 28.8 and 56 Kbps, we used the default settings in both encoders to create files of 16 to 20 Kbps for 28.8-Kbps transmission, and files of 30 to 34 Kbps for 56K transmission. Microsoft claims that its files are superior to MP3 at half the bandwidth. To verify this, we encoded files to 64 and 128 Kbps in G2, WMT, and MP3 formats, using Xing Technologies' AudioCatalyst.

We used a 200-MHz Pentium/MMX PC with a Creative Labs AWE32 sound card and Cambridge

overemphasize bass sounds at the expense of treble, while WMT emphasized treble but provided better balance. When we compared WMT's 32-Kbps files with MP3's 64-Kbps files, though, MP3 won five of six tests. This casts doubt on Microsoft's claims of similar quality at half the bandwidth.

Note also that at 64 Kbps and above, all technologies produced excellent quality that was difficult to distinguish from the original. But at low bandwidths, WMT is the codec to beat.

UNDER THE HOOD: Microsoft added an audio equalizer (shown here) and video display controls.

OTHER COMPONENTS

Though Windows Media Player looks the same, Microsoft made several changes under the hood, including brightness, contrast, and color controls for video playback; a graphics equalizer for audio; and video filtering during playback to improve video quality. All three features are available from Real, but you'll have to upgrade to the Real-Player Plus (\$29.95) to get audio and video adjustments.

Microsoft made only minimal changes to its encoding and content creation tools, partnering with Sonic Foundry to create the free On-Demand Producer (ODP). ODP is a step in the right direction, with batch encoding and HTML creation. But Real's tools are still more intuitive and provide more advanced features, such as a compression expert.

Real's tools and player remain ahead in appearance and usability, and Real enables more compelling low-bandwidth presentations. But the heart of streaming media for most Web sites is format quality, and Microsoft's ability to output better low-bandwidth audio should turn some heads in the streaming media market.

Microsoft Windows Media Technologies 4.0, Beta. Media Player and Media Tools: Free. Requires: 16MB RAM, Windows 95, 98, or NT 4.0. Microsoft Corp., Redmond, WA; 800-426-9400; www.microsoft.com/windowsmedia.

LOOKS FAMILIAR:

Windows Media Player appears much the same as NetShow on the surface.

components—encoding tools, player, and server—must also be considered when comparing technologies. Here, we focus on format quality, encoding tools, and the player (we'll review the server in an upcoming issue). For side-by-side comparisons of WMT with G2 and MP3, go to our Web site, www.pcmag.com.

AUDIO GOES HEAD-TO-HEAD

To test audio quality, we encoded six test files to four bandwidths with Real's G2 and Microsoft's WMT. The test files included four music tracks with rock, classical, and folk music,

Soundworks' Desktop Theater speakers as a playback station. We performed three jury tests: Real versus WMT at 28.8 and 56 Kbps and a 32-Kbps WMT file versus a 64-Kbps MP3 file. We played back G2 files using the RealPlayer Plus, and we used Windows Media Player 6.02 for MP3 and WMT files.

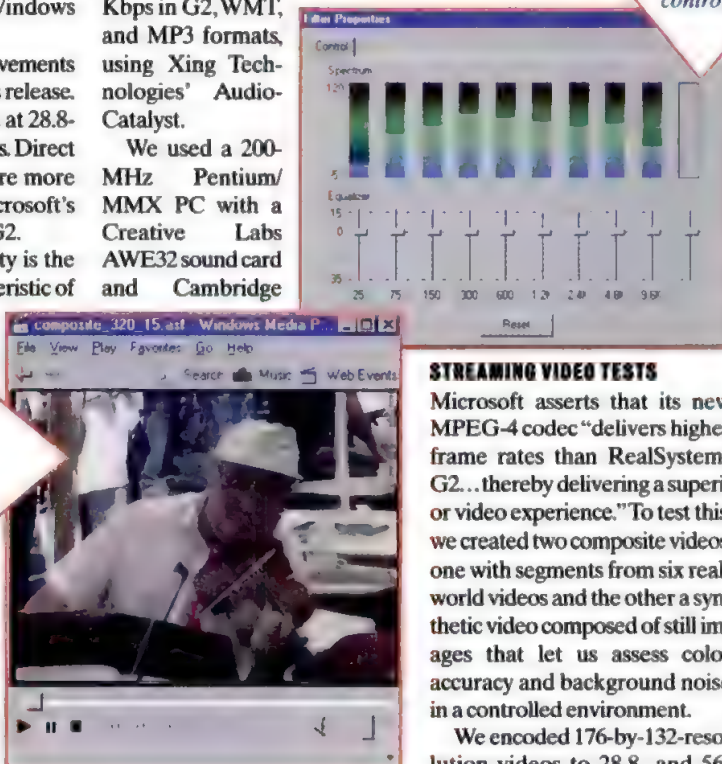
At both 28.8 and 56 Kbps, WMT won four of the six tests. With music tracks, G2 tended to

STREAMING VIDEO TESTS

Microsoft asserts that its new MPEG-4 codec "delivers higher frame rates than RealSystems G2...thereby delivering a superior video experience." To test this, we created two composite videos, one with segments from six real-world videos and the other a synthetic video composed of still images that let us assess color accuracy and background noise in a controlled environment.

We encoded 176-by-132-resolution videos to 28.8- and 56-Kbps targets using presets in the Real and WMT encoders, and then 320-by-240 videos to 100- and 200-Kbps data rates. All clips were targeted at 15 frames per second (fps), but both encoders adjust output frame rate dynamically, according to motion in the source video, so actual frame rates varied for each.

WMT consistently delivered higher frame rates than G2. The visual experience, however, was





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Low-Cost Office Suites

Three vendors deliver simpler and less costly suites that mirror the basic features of big-name packages.

By Stephen W. Plain

Whether you're working on your office PC or your home computer, word processors, spreadsheets and graphics programs are most likely your staple applications. These programs are the cornerstones of office suites like Lotus SmartSuite and Microsoft Office—packages that continue to grow in complexity and price. But although office suites have moved to a higher level of functionality, the more complex features are often irrelevant for home users.

Three companies—Ability Plus Software, Software602, and Star Division—are delivering simpler and less costly suites that mirror the basic features of better-known offerings. The suites are targeted at core functionality and are readily available for download, free or for prices up to \$69.95. Aside from the obvious benefit of their budget costs, the suites usually gobble up less disk space than mainstream programs. They're most appealing to home users—though recent buyers of PCs have likely received a suite bundled in their boxes. Still, many machines, such as home-built or upgraded systems, lack modern core applications.

Although these low-cost packages may fill your basic document needs, you should be prepared for the occasional terse error message and shallow help-file topic. Nevertheless, for those who need a low-cost suite alternative with basic functionality, these second stringers present some interesting application combinations and are worth a look.

ABILITY OFFICE

Ability Office (\$69.95 direct), from Ability Plus Software, includes all of the major pieces of an office suite but suffers a bit from compatibility gaps. The

suite, a 7.8MB download, includes Ability Database, Ability Draw, Ability Spreadsheet, and Ability Write; the company also sells the first three components individually for \$29.95 each and throws in the fourth for free with any purchase.

The central interface for the suite is Ability Launcher—a customizable program-launcher toolbar. In addition to providing access to the suite's applications, this toolbar accepts icons for other applications and includes a universal open dialog tabbed for each type of application document. This simple approach is

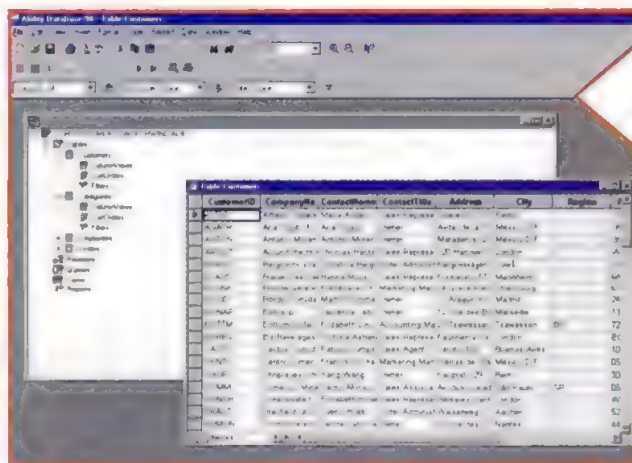
base and Microsoft Access databases, but the mailing-label feature is available only in Ability Database. The program wisely places common special objects such as date/time stamps, callouts, footnotes, and mail-merge fields under the Insert menu, but we had difficulty deleting callouts after inserting them.

Ability Spreadsheet is a moderately complete application, but it does have some compatibility issues. You can open multiple worksheets and workbooks, but you can only open one sheet at a time from a multisheet workbook. The program can open Excel documents with formulas, but Lotus 1-2-3 formulas are not recognized. The program does include a robust set of its own functions.

drawing capabilities to the suite. This program is more similar to Microsoft Paint than to Adobe PhotoDeluxe, however. It may be useful for occasional icon editing and other simple tasks but not for image manipulation.

Although Ability Office has some bright spots—particularly the database and spreadsheet components—it is not the right choice for compatibility-minded users. If you don't plan to move files back and forth between suites, however, Ability Office is a reasonable solution.

Ability Office. Direct price: \$69.95. Requires: 16MB RAM, 30MB hard disk space, Windows 95, 98, NT 3.51, or NT 4.0. Ability Plus Software Ltd., London; fax: 209-671-6371; e-mail: pcmus@ability.com; www.ability.com.



IN CONTROL: The Ability Database component of Ability Office gives you flexible control over your data and lets you define multi-table schemas with permanent relationships.

602PRO PC SUITE

602Pro PC Suite, from Software602 (\$49.95 direct), comprises word processor, spreadsheet, photo-manipulation, and integrated desktop programs. Each component has the comfortable look and feel of a feature-complete application. The package, a 13.7MB download, lacks a database program but offers mail-merge functionality in its 602Text word processor, which works with existing CSV and DBF files as well as ODBC data sources.

602Text has all of the standard word-processor building blocks, including multiple floating toolbars, various views, selectable type styles, a spell-checker, and a thesaurus. Also included are such built-in Web features as an HTML Look view, a preview of the HTML source, and menu entries for transferring files to and from the Internet via FTP or HTTP.

In testing, we noted that the dictionary and thesaurus were not as complete as we expected,

quick but doesn't provide the document management and preview features of 602Desk (reviewed below).

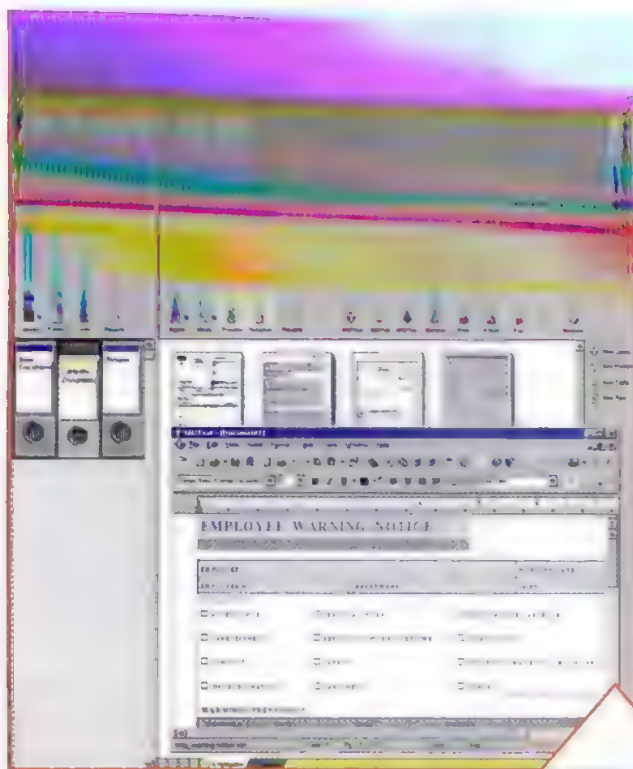
Ability Write offers a basic multiple-document word processing interface and includes plenty of basic formatting functionality, but it's a bit limited in file compatibility. The program didn't recognize graphics reliably from our RTF test files, and it didn't recognize Word 97 format documents consistently. On its Web site, the vendor clearly points out its applications' limitations and promises updates.

The word processor includes simple mail-merge functionality that works with Ability Data-

base and Microsoft Access databases, but the mailing-label feature is available only in Ability Database. The application stores tables, queries, forms, and reports in individual databases and provides a fairly well-honed visual interface. You can create these objects from scratch or with simple wizards.

The relation objects are especially important, since they enable you to build complex data structures with interrelated tables. Form and report functionality is useful and straightforward. The database imports many popular data formats, but Access forms and reports are not supported.

Finally, Ability Draw adds



StarOffice is marketed as a Microsoft Office-compatible suite and offers the broadest array of applications in this group: a word processor, spreadsheet program, drawing program, database, presentation application, and schedule.

Using StarOffice requires a little more of a learning commitment than the others. The suite is tightly integrated—perhaps too much so—into a central interface that combines the organizational elements of Windows Explorer and the navigational feel of a Web browser.

The interface is fine if you're willing to jump into StarOffice with both feet, but it's not very intuitive for occasional use.

StarWriter, the word processing program, did a good job of importing our Word 97 documents. But since the programs are all attached to the central interface, it has a different feel than the other word processors. For example, when we attempted to open a file, all document types, including graphics and presentations, were listed along with word processing formats. The program of-

Among the spreadsheet programs we tested here, StarCalc offered the smoothest Excel compatibility. We were able to open multisheet workbooks with graphs and formulas and save them in Excel 97 format. The program included both 2-D and 3-D charts. StarBase is similar to Ability Database 98 and is integrated into the StarOffice Explorer interface.

In presentation and scheduling functionality, StarOffice goes beyond the other two budget suites. StarImpress—the presentation program—is a surprisingly complete package, with top-notch transitions and navigation control. We built presentations rapidly and exported them to hyperlinked HTML pages quickly for publishing to the Web.

StarSchedule is accessed from StarOffice's Explorer and lets you schedule events and manage tasks. This is the weakest link in the suite, since you must wade through a cumbersome UI to work with your schedule. Finally, there's StarDraw, which serves as a hybrid paint-and-photo-manipulation tool. It features some snappy 3-D rendering and other special ef-

but we found plenty of nice surprises. The program offers form objects such as Submit buttons, radio buttons, drop-down select-list boxes that simplify HTML coding, and a built-in e-mail merge feature.

The suite's spreadsheet program, 602Tab, closely mimics the look and behavior of Microsoft Excel, albeit with a simplified feature set. The program also supports all of the basic calculation, financial, and statistical functions. 602Tab opened our Lotus 1-2-3 and Excel 97 workbooks, and graphing was literally a one-click affair. We simply highlighted data and hit the chart button, then chose among 16 chart styles.

passes its price in value. The component applications are simple to use and offer usable home companions to the mainstream business suite you use at the office.

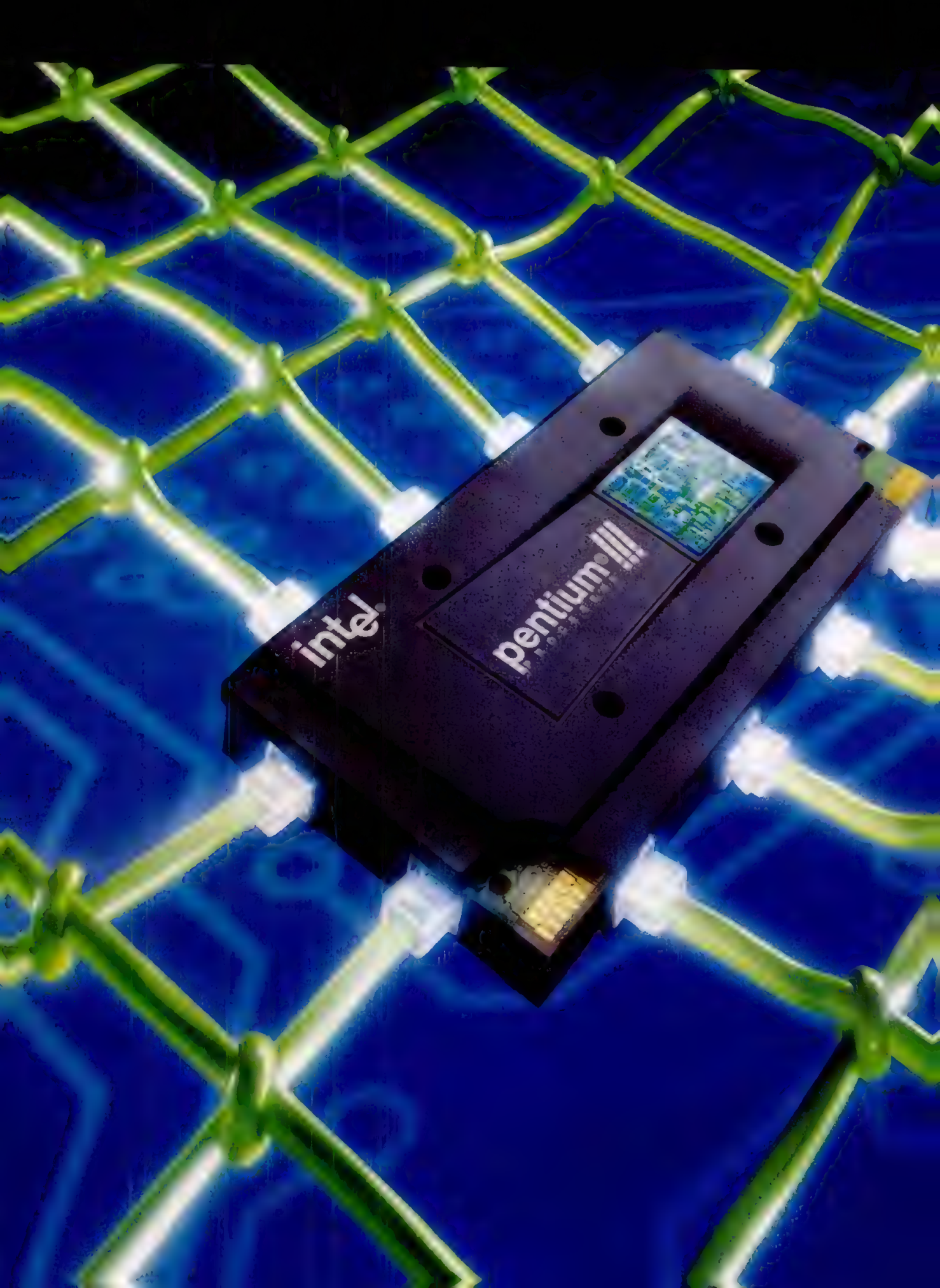
602Pro PC Suite. Direct price: \$49.95. Requires: 8MB RAM for Windows 95 and 98, 16MB for Windows NT 4.0 or later; 25MB hard disk space. Software602 Inc., Jacksonville, FL; 888-468-6602; www.software602.com.

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The Computer Inside.™

Fix What Ails Your PC

Fix-It Utilities 99 offers a powerful set of utilities for impatient beginners and careful experts alike.

By Edward Mendelson

To put it plainly, Mijenix Corp.'s **Fix-It Utilities 99** (\$49.95 list) makes every other Windows utility package look clumsy, underpowered, and obsolete. It's the only advanced utility package built from the ground up for 32-bit Windows, with a consistent, browser-style interface that won't intimidate users, and it has a full range of features for Windows 95, 98, and NT.

For a quick tune-up of an entire Windows system, Fix-It provides **FixWizard**, which runs a subset of the package's separate tuning and repair modules. Before **FixWizard** starts, you can choose whether to run the package's virus checker, Y2K-compliance tester, system-file backup feature, unneeded-file remover, disk-repair module, Registry cleaner, or defragmenter. **FixWizard** and separate modules can be run either from the program's central control panel or from the Windows Start menu, but all the modules are so tightly integrated that a single Undo module reverses system changes made by any part of the entire package.

A unique feature creates a Windows NT command prompt to which you can boot in an emergency when Windows NT won't boot to the desktop. By booting to this emergency system, you can perform basic operations until the damaged system is restored, such as copying and renaming files.

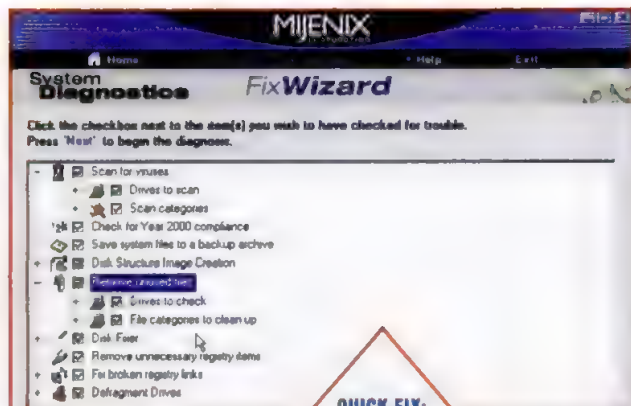
Registry-repair modules correct entries that point to moved or nonexistent files and remove nonessential entries; another module tweaks the Registry to customize Windows' look and feel. Fix-It's crash protector intercepts program faults before they can bring down your system.

In addition to real-time system monitors, Fix-It's diagnostic func-

tions include a hardware checker based on the classic QA+ program from Sykes Enterprises and the eSafe virus checker from Aladdin Knowledge Systems. Both of these licensed modules look and feel like integral parts of the Fix-It package.

Fix-It's chief rivals are Symantec's Norton Utilities 4.0 and Network Associates' Nuts & Bolts 98. Both have features not found in Fix-It (DOS-based disk editors, for example) but are burdened by relatively incoherent and archaic designs.

Fix-It has a few first-version glitches. For example, the Registry-repair function in **FixWizard** crashed on one test system



QUICK FIX:
FixWizard can scan and repair an entire system in a single operation.

until we ran the full-scale Registry-repair module. But as a whole, Fix-It Utilities 99 is impressively smooth and trouble-free; it also includes a copy of Mijenix's **PowerDesk 98**, the best available Windows file manager. If you already own other utility packages, you'll probably delete

them after trying Fix-It.

Fix-It Utilities 99.
List price: \$49.95.
Requires 8MB

RAM, 20MB hard disk space, Windows 95, 98, or NT 4.0. Mijenix Corp., Boulder, CO; 800-645-3649; www.mijenix.com.

Web Audio to Go

The new Audible MobilePlayer-Plus can hold 7-plus hours of downloaded audio content.

By Bruce Brown

PC-connected portable audio solutions are hot products, particularly those that can access and play back content from the Internet. The new Audible **MobilePlayer-Plus** (\$299 direct), which falls into this category, is a flexible, easy-to-use 16MB audio player that can load more than 7 hours of audio content.

The compact, 3.5-ounce **MobilePlayer-Plus**, measuring 4.6 by 2.9 by 0.8 inches (HWD), comes with two rechargeable batteries, headphones, and a cassette adapter. You download content from Audible's Web site (www.audible.com), and the **MobilePlayer-Plus** plays back via headphones, an unused local FM radio station, or a car's cassette player. Only Audible's own file formats can be loaded on the player.

To load audio content, you put the **MobilePlayer-Plus** in the

docking station, which connects to a PC via serial cable. The program for downloading and managing files, **AudibleManager 2.0**, is included. You must have an account with Audible and activate the **MobilePlayer-Plus** to download audio content and transfer it to the player.

UPWARD MOBILITY:

On the MobilePlayer-Plus, listen to live performances, books, conferences, and newspaper feeds.

Only one player can be activated per user account at a time, to prevent unlicensed sharing of content. Downloaded files are stored on the PC and then transferred to the **MobilePlayer-Plus**.

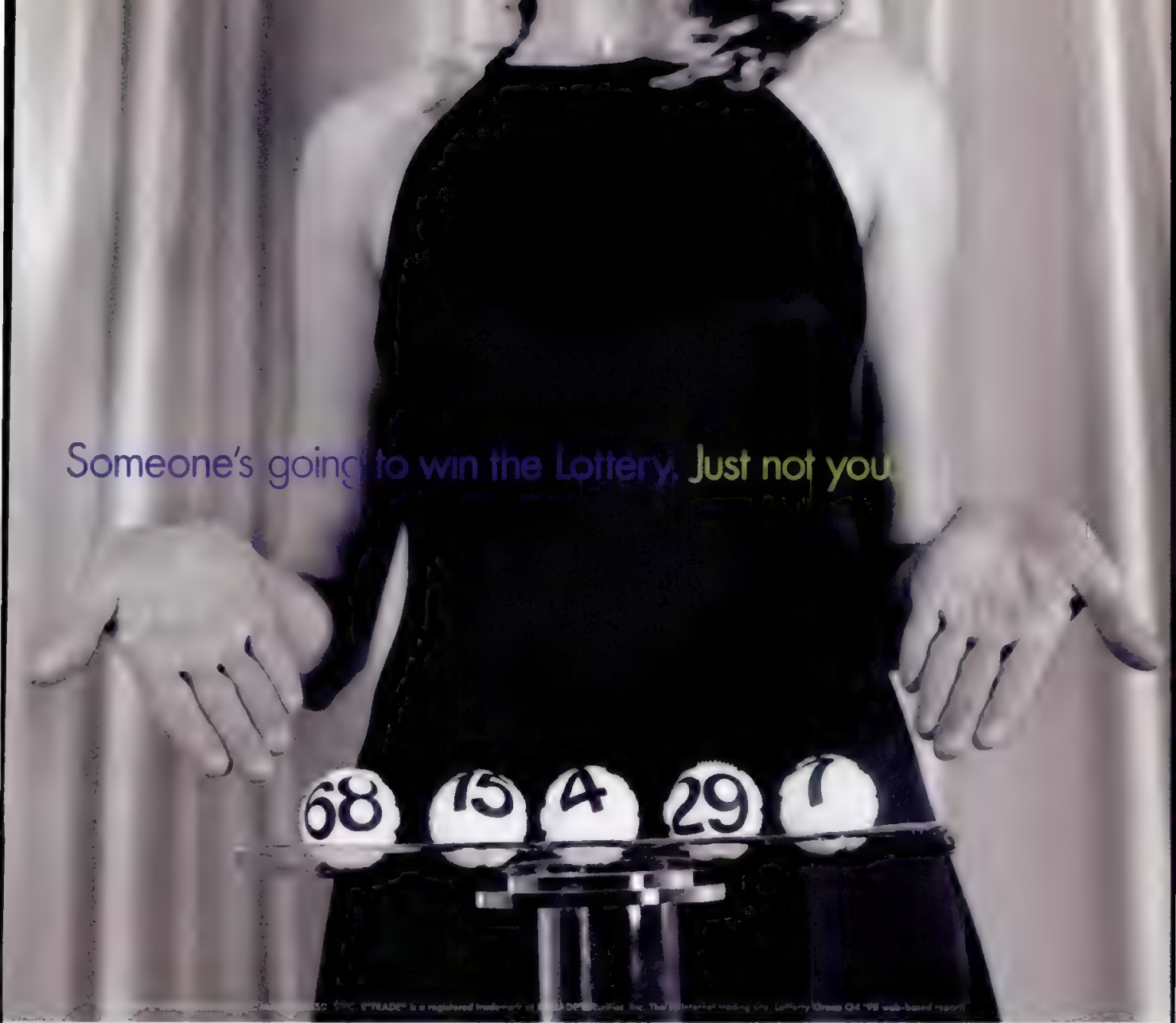
More than 16,000-plus hours of spoken audio files are avail-

able for sale on Audible's Web site, including unabridged best sellers (\$15 to \$20), abridged fiction and nonfiction titles (\$5 to \$10), and periodicals, such as one month of twice-daily summary downloads of the *Wall Street Journal* (\$10) or one year of selected daily downloads from *The New York Times* (\$50). Audible's audio files use roughly 1MB of storage space per 30 minutes of content, compared with MP3 audio files, which use about 1MB per minute.

The variety of ways in which you can use the Audible **MobilePlayer-Plus**, along with the ease of perusing and buying content, make this product a winner.

Audible MobilePlayer-Plus. Direct price: \$299. Requires: 32MB RAM, 25MB hard disk space, Windows 95, 98, or NT 4.0 with Service Pack 3.0. Audible Inc., Wayne, NJ; 888-283-5051; www.audible.com.





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PDA-Assisted Paging

BeamLink 2.0 sends PDA messages to pagers, e-mail addresses, and phones via pager.

By Marge Brown

For two-way paging without being restricted by the minuscule real or virtual keyboards of pager units,

FIRST:

Compose messages on your PDA and beam them to the pagers via IR.

check out JP Systems' BeamLink 2.0 (\$50 street). BeamLink is message management software that lets you use a Palm III, IIIx, or V, or an IBM WorkPad with a Glenayre AccessLink II pager to send and receive e-mail and pages via infrared beaming. Broadcast messaging and ease of use are BeamLink's strengths, though juggling messages between two PDAs with different interfaces can be cumbersome.

To use BeamLink, you compose e-mail, telephone messages, and pages on the PDA and beam them to the pager for simultaneous delivery through MCI's or Skytel's two-way paging networks. BeamLink can also download received pages to Palm devices for better readability.

BeamLink provides efficient messaging screens with a link to the Palm device Address Book. When you are ready to send your message, you align the IR ports of the Palm organizer and the pager and push any pager button. The IR port, like two-way paging, works only when the pager is in a full-service area and is detected automatically by the pager.

BeamLink supports sending up to 800-character e-mail messages and 500-character pages to multiple types of addresses and

to multiple recipients. For instance, you can send a single message announcing a meeting to e-mail addresses, pager numbers (one-way or two-way), and U.S. telephone numbers. Telephone messages are read to the recipient by an electronic voice.

In testing, IR transfer between a Palm III unit and the AccessLink II worked easily, and all types of messages transmitted flawlessly. The electronic voice delivered the message with no errors; the mes-

sage itself was clearly understandable.

BeamLink includes message folders as well as canned messages, prints e-mail to an infrared-capable printer with Stevens Creek Software's PalmPrint (\$40 street) installed, and handles limited e-mail attachments to other users of BeamLink and JP Systems' One-Touch Communicator. BeamLink also can transfer up to 1,500 Address Book entries to the pager—a handy feature.

BeamLink 1.0 users can upgrade to the new version at no extra charge. The developer's Web site has purchase plans for BeamLink 2.0, the Palm III, the AccessLink II, and paging service packages.

BeamLink 2.0 adds power



THEN:
Use the AccessLink II to deliver your messages via satellite.

to two-way paging, because of the Palm's significantly better writing, editing, and address-handling capabilities. Because you have to carry both devices and cope with their different interfaces to reap these benefits, though, the current im-

plementation will be most appealing to gadget gatherers and consummate communicators. **BeamLink 2.0.** Street price: \$50. Requires: 8MB RAM; 12MB hard disk space; Microsoft Windows 95, 98, or NT 4.0 or higher; 3Com Palm III, IIIx, or V or IBM WorkPad, with 150K free memory; Glenayre AccessLink II. JP Systems Inc., Dallas; 888-655-2460; www.jpssystem.com.

Create Web Auctions

OpenSite Auction 4.0 helps you bring your Web customers into the world of electronic auctions.

By Richard Dragan

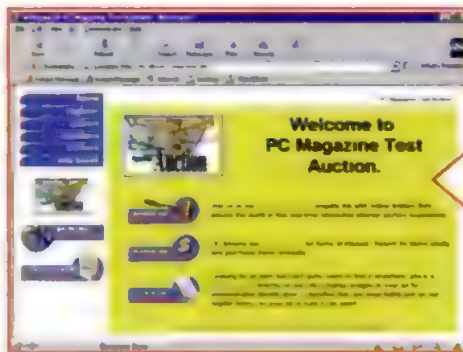
With excellent browser-based administration capabilities and out-of-the-box functionality, OpenSite Auction 4.0, from OpenSite Technologies, can add extensive auction capabilities to any Web site. Despite its current lack of developer support on the high end, this package may be your next e-commerce step.

Since Auction 4.0 runs using CGI scripts and server-side filters, it runs on all major flavors of Intel-based Unix and on IIS on Windows NT 4.0, as well as on SPARC Solaris Unix. We were impressed that after a quick installation (a few minutes), the product gave us a rich auction Web site, letting us manage bidders, categories, and products, without any HTML customization or programming.

Management of the entire site, via a browser, is excellent. You can customize your site with over a dozen predefined styles. Publishing changes on a working site from our staging

etary, text-based database format (manipulated by CGI scripts). To integrate this database into a legacy system, developers will likely need to delve deeply into this proprietary script code.

The advantages of OpenSite Auction 4.0 are obvious: It offers a good range of auction capabilities, fine browser-based administration, and a fully working site in just a few minutes.



GOING ONCE:
Auction 4.0 lets you build a full-featured auction Web site in just a few minutes.

OpenSite Auction 4.0 Corporate Edition. List price: \$50,000. Requires: For

area via FTP was easy.

On the back end, the Corporate Edition (\$50,000 list) gives you the option of connecting to Oracle 8 databases directly. The Merchant Edition (\$15,000) and Professional Edition (\$5,000) don't offer this capability. All three editions support a propri-

Web server: 128MB RAM; 50MB hard disk space; Microsoft Windows NT 4.0 with Service Pack 3 or SPARC Solaris 2.x. For client: 16MB RAM; 50MB hard disk space; Windows 95, 98, or NT. OpenSite Technologies Inc., Research Triangle Park, NC; 919-544-1993; www.opensite.com.

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 e-business tools

Notebooks on the Cheap

New portables from Compaq and Dell prove you don't have to break the bank or sacrifice features.

By Carol Venezia

Many people don't buy notebook PCs because they're not willing to cut back on features to get a system that's affordable. If you're among this crowd, there's good news: The latest mobile processors from AMD and Intel are enabling a new generation of notebooks with top-of-the-line features priced under \$2,500.

Here we review two systems running on low-power, low-cost CPUs specifically designed for notebooks. First is the Compaq Prosignia Notebook 150 (\$2,248 direct), which uses AMD's 380-MHz Mobile K6-2 processor. Then we discuss the new Dell Inspiron 3500 (\$2,279 direct), powered by Intel's 366-MHz mobile Celeron.

Though these machines are designed differently, each offers generous amounts of RAM, a big display, and great performance for the price. The Inspiron was slightly faster and lasted longer on our BatteryMark test, but the Prosignia offers DVD and good 3-D performance.

COMPAQ PROSIGNIA NOTEBOOK 150

If you don't like carrying spare drive modules around, the all-in-one design of the Compaq Prosignia Notebook 150 could be appealing. This system is a bit heavier than the Inspiron, but all three spindles—floppy disk drive, 4X DVD-ROM drive, and hard disk—are integrated.

On paper, the Prosignia certainly sounds like a powerful piece of machinery. Along with the AMD 2.2-volt processor, it has a huge 1MB L2 cache. To date, 380 is the biggest megahertz number you'll see tied to a

mobile-specific CPU. Compaq's online advertising claims that the Prosignia has a 100-MHz frontside bus, but system memory actually runs at 95 MHz (95 divides equally into 380; 100 doesn't).

Regardless, the Prosignia performed quite well

on our ZD Business Winstone 99 tests. This portable posted a score of 16.4, just two-tenths of a point behind the Inspiron 3500, as well as the average Pentium II/366 notebook tested in our roundup of February 23, 1999. Its battery life was also respectable, at 2 hours 40 minutes.

But the big news about the Prosignia is the many high-end features that you'll get for such a paltry price. Housed inside the system's slightly chunky, 2-by-12-by-10-inch case (HWD), you'll find a 14.1-inch active-matrix display, 64MB of RAM, a 56K modem, and a 6.4GB hard disk. The

SLIGHTLY SLIMMER:
The Inspiron's modular design results in a lighter, less bulky portable.

notebook and AC adapter together weigh 8.3 pounds.

Another thing you wouldn't expect to find is a decent graphics subsystem. But this Prosignia breaks the rules: Its ATI Rage LT Pro AGP 2X graphics chip

set is augmented by 8MB of memory—a feature currently duplicated only by a handful of other notebooks. These parts contributed to a respectable 119 on our 3D WinMark tests.

Our only real gripe with the Prosignia is with its keyboard. On the plus side, there are four quick-launch buttons (at the base of the wrist rest below the touchpad), which take you online or launch applications. But the keyboard itself was overly springy, the Spacebar was too short, and the Backspace key wasn't full size, which made hitting a key near it by mistake all too easy.

THREE-IN-ONE:
Floppy disk drive, DVD-ROM drive, and hard disk are built into the Prosignia.

Minor quibbles aside, the Compaq Prosignia Notebook 150 really is a great value.

Compaq Prosignia Notebook 150. Direct price: \$2,248. Compaq Computer Corp., Houston; 800-888-5858; www.compaq.com.

DELL INSPIRON 3500

Dell takes a slightly different approach to the affordable SOHO notebook with its Inspiron 3500 series. This machine is a two-spindle

(\$139), a second battery (\$119), or a floppy disk drive. The included floppy disk drive comes with a parallel cable so you can use it externally.

The Inspiron's modular design translates to a less bulky system. The Inspiron is half an inch thinner and nearly 1 pound lighter equipped for the road than the Prosignia. But it still has a 14.1-inch screen, 64MB of RAM, and a 6.4GB hard disk. Unlike the Prosignia, you can remove the hard disk and upgrade it yourself.

One feature we'd love to see is the ability to swap modules without shutting down. The Inspiron doesn't support either warm- or hot-swapping of devices, so if you want to switch what's in the modular bay, you have to shut the notebook down first.

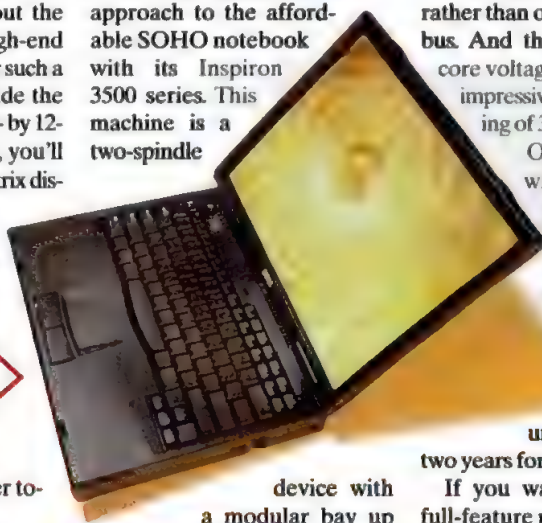
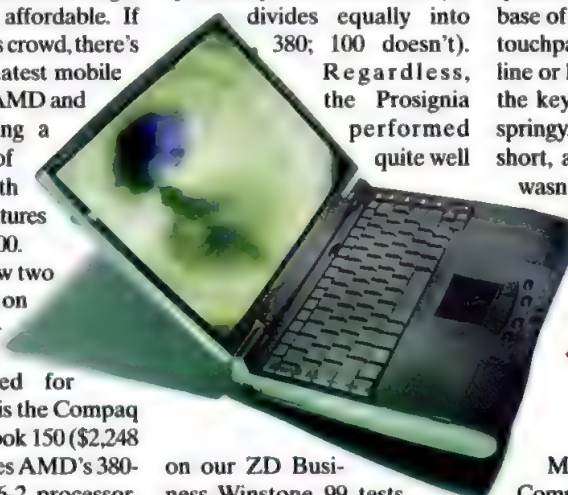
Benchmark testing showed the Inspiron to be a capable performer. It posted a Winstone test score of 16.6, which is right in line with the average PII/366 portable. Boosting performance is the 366-MHz Celeron chip's cache architecture: The processor may have only a fraction of the L2 cache that the Mobile K6-2/380 has (128K versus 1MB), but the cache runs at full CPU speed, rather than on a slower, off-chip bus. And the Celeron's lower core voltage of 1.6 aided in an impressive BatteryMark timing of 3 hours.

One key area in which the Dell unit outguns the Compaq unit is in its standard warranty—three years, rather than one (although you can upgrade Compaq unit's warranty to

two years for \$99).

If you want a flexible yet full-feature notebook, the Dell Inspiron 3500 will impress.

Dell Inspiron 3500. Direct price: \$2,279. Dell Computer Corp., Austin, TX; 800-999-3355; www.dell.com.



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Predict the Future

Decisioneering's CB Predictor helps you anticipate trends, even without a degree in statistics.

By Craig Stinson

The past is no certain guide to the future, but it's often the only guide you have when making purchasing or inventory decisions about anticipated sales or demand. To help you make defensible decisions based on historical data, Decisioneering offers CB Predictor (\$495 list), a new forecasting add-in for Excel. (CB stands for Crystal Ball, Decisioneering's flagship risk-analysis tool.)

CB Predictor performs eight kinds of time-series forecasting, as well as forecasts based on multiple linear-regression analysis. The time-series methods include four for nonseasonal data (single and double moving averages, and single and double exponential smoothing) and four for seasonal data (seasonal additive and multiplicative, and Holt-Winters additive and multiplicative).

You won't need an MBA or a degree in statistics to use CB Predictor effectively, however. Decisioneering has done an excellent job of shielding the product's complexity. You indicate whether you want to extrapolate from historical data (your sales figures, for example) or to find regression coefficients linking your data to other factors (the weather or the price of oil, for instance). Beyond that, using CB Predictor is a matter of walking through a wizard.

The wizard detects the range and layout of your data, determines the data's periodicity (whether it's daily, weekly, or monthly, for example), checks for seasonal patterns, and calculates the forecasting method that's most likely to give an accurate result. After confirming or overriding the wizard's choice of method, you indicate how far into the future you want to project, where you want the forecast data to appear, and which optional re-

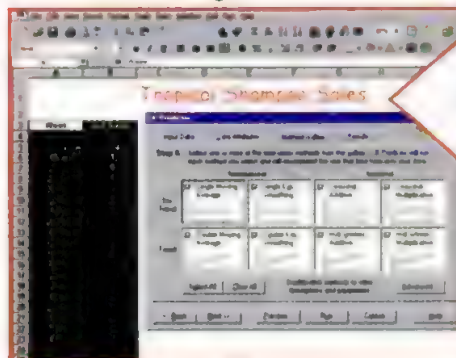
ports and charts you want to see.

Forecast data points arrive as either constants (for time-series extrapolations) or formulas (for predictions derived from regression), displayed in a contrasting format of your choice. Crystal Ball users can have forecast results automatically applied to a Crystal Ball risk-analysis scenario.

Optional reports and charts show a confidence range above and below predicted values (letting you see what range of values can be predicted with a desired probability) and the

degree of error associated with each of the program's forecasting methods (so sophisticated users can make intelligent deci-

anyone who needs to make intelligent guesses regarding future costs, revenues, supply, or demand. Its integration



EASY FOR ANYONE:
A cleanly designed wizard makes forecasting with CB Predictor a snap.

with Crystal Ball makes it especially suitable for users who also need to quantify the risk

sions about overriding the program's default method choice).

CB Predictor's transparent design and simplicity makes the software an excellent choice for

associated with their forecasts. **CB Predictor 1.0.** List price: \$495. Decisioneering Inc., Denver; 800-289-2550; www.decisioneering.com.

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You don't have to be a programmer to let AutoMate 4.2 perform your repetitive PC tasks.

By Alfred Poor

Anyone who uses a computer on a daily basis has routines. Your day might start with logging on to a Web site to see how your portfolio is doing, and you probably check e-mail periodically; you might end your day by backing up critical files. If you'd like to reduce repetitive tasks to a keystroke, then take a look at AutoMate 4.2, from Unisyn Software. We found the program simple to use, and it has extensive and informative help.

The program comes in three versions: Professional (which we tested) and Pro NT—both of which include Visual Basic and are priced at \$179.95 (direct)—and Standard (\$59.95), which can be downloaded for a free 30-day evaluation from Unisyn's Web site (www.unisyn.com). We recommend Standard for most users and Professional for

those who need the power and flexibility of creating their own Basic procedures.

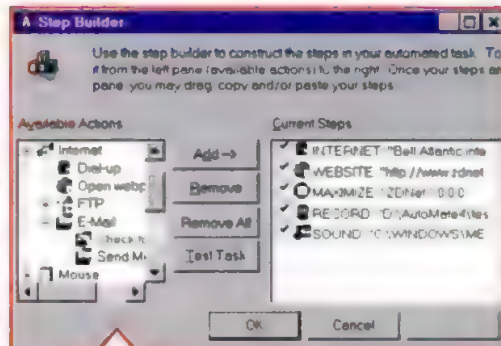
You don't need to know any programming to make AutoMate work, though: The Step Builder screen lists a wide range of actions, such as running an application or sending keystrokes. You can open and close windows and change the focus from one

Once you've assembled the sequence of steps in a task, you can trigger it by running the task from the AutoMate window, but you also have many other choices. For example, you can specify a hotkey combination to trigger the task or specify a time or interval for the task to occur.

AutoMate has a number of built-in security features. The keyboard or mouse or both can be locked, preventing input while a task is running. You can password-protect a task to prevent the task from being examined or edited without permission and require a password before a task will execute.

For programmers, there are steps for flow control, including loop and prompt commands. And the language editor lets you create more complex steps.

AutoMate 4.2. Direct price: Standard, \$59.95; Professional and Pro NT, 179.95 each. Requires: 8MB RAM, 20MB hard disk space, Windows 95, 98, or NT. Unisyn Software LLC, Los Angeles; 213-738-1700; www.unisyn.com.



SET IT UP:
Build your task within AutoMate's Step Builder window, then specify when it should run.

window to another. By dragging and dropping items in your task sequence, you can play a sound, print a document, or even reboot or shut down the computer.

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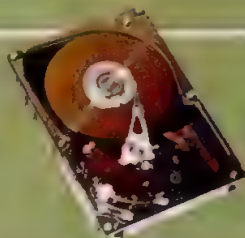
25 OF THE 25 TOP PERFORMING COMPUTER SYSTEMS USE SEAGATE DISC DRIVES.

HMMM. WITHOUT OVERTHINKING THINGS, IT LOOKS LIKE THERE'S
A STRONG CORRELATION BETWEEN HIGH PERFORMANCE COMPUTER
SYSTEMS AND HIGH PERFORMANCE SEAGATE DRIVES.

Have you heard of TPC? (AKA the Transaction Processing Performance Council.) Basically it's a highly professional non-profit group that tortures computer systems to the limits of performance to establish benchmarks. Recently, at TPC's grueling server trials, it turned out that every one of the top 25 highest performing servers used Seagate disc drives. Specifically Cheetah[®], the world's fastest. Technically speaking, it was a slam dunk. This is important to know, because disc drives can account for up to 39% of the cost of a high performance server. Which is why, when all the top server brands wanted their money's worth, they chose Seagate. Who else?

FYI:  Find TPC at www.tpc.org

FYI



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Price	7,200	7,200	10,000	10,000

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Wireless Alternative

The Clarinet Systems EthIR LAN proves worthy competition for radio-based wireless solutions.

By Les Freed

This past year, we've seen a rush of products based on the 2-Mbps IEEE 802.11 wireless networking standard. These wireless systems require special LAN adapter cards and driver software on each client PC, adding cost and complexity to your network. Infrared-based systems are not as technologically impressive as radio-based systems, but they do offer many advantages and their prices are competitive.

The new Clarinet Systems EthIR LAN Access System (\$1,279 list for the EthIR Switch Model ES208, and \$60 for each EthIR Beam access unit) provides an easy, inexpensive way to connect infrared-equipped laptops and palmtops to the corporate LAN. The EthIR LAN provides a fast, reliable connection—up to 4 Mbps—without the additional expense and power consumption of radio-based wireless products.

MAKING CONNECTIONS

You build an EthIR LAN using Clarinet Systems' EthIR Switch and one or more EthIR Beam access units. The EthIR Switch looks and works like a standard Fast Ethernet switch, but it supports eight conventional Fast Ethernet connections and eight EthIR Beams. The EthIR Beams are small, plastic wedges about the size and shape of a mouse that connect to the EthIR Switch via a standard Cat

5 cable. (You can use up to a 100-meter length, but a 7-foot cable is included.) The EthIR Switch provides power to the EthIR Beams over the cable, eliminating the need for batteries or an external power supply on the EthIR Beams.

LINK UP:
The EthIR Switch can handle up to eight EthIR Beams; each beam, in turn, supports one client PC at a time.

The EthIR Beams have a range of about 3 feet, and they provide connections at 115,200 bps

using the older IrDA 1.0 SIR standard or 4 Mbps using the newer IrDA 1.1 FIR standard. Virtually all infrared-equipped 486-class and later PCs use one of these two specifications, so compatibility with your existing fleet of laptops and handhelds is assured. The EthIR Beams have nonskid feet on the bottom and an activity LED on the top. Each EthIR Beam connects to one client PC at a time.

EFFORTLESS INSTALLATION

Installation is straightforward. You start by attaching the EthIR Switch's uplink port to your existing LAN and running the provided EthIR Switch Tool configuration program from any PC on the LAN. EthIR Switch

Tool automatically locates all the EthIR Switch devices on the LAN, letting you check and change the configuration settings on any of them. You can also configure the EthIR Switch via infrared by running EthIR Switch Tool on an infrared-equipped Windows 95 notebook. The initial configuration is simple; in most cases, you'll need to set only the EthIR Switch's IP address and create a DHCP address pool.

If your client PCs are running Windows 95, Windows NT 4.0, or Windows CE 2.0, you probably won't need to install any additional software to make them work with the EthIR

LAN. But some older notebook PCs may require an infrared driver update to operate at 4 Mbps. Clarinet Systems includes a floppy disk containing the Windows

98 CD-ROM before they can connect to the EthIR LAN.

To connect a PC to the system, you fire up the PC and place an EthIR Beam near the PC's infrared port. Windows 95, NT 4.0, and CE 2.0 users simply log on as they would with any standard Ethernet connection. Windows 98 users must manually start DCC, select the infrared port, and click "connect." Clarinet Systems is working on a better solution for Windows 98 users.

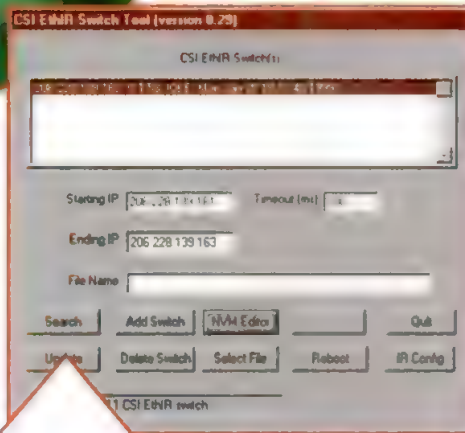
PERFORMANCE MATTERS

We tested the EthIR LAN with a variety of infrared-equipped notebook, laptop, and hand-held PCs, including an Apple PowerBook 1400, a Compaq Windows CE hand-held, an IBM ThinkPad 560X, a Toshiba Libretto 70, and an infrared-equipped iMac. All units worked well with little or no tweaking required on the client PCs. Informal benchmark tests using NetBench showed the EthIR LAN's throughput to be about 3.5 Mbps—nearly twice as fast as the 802.11 radio-based wireless systems that we've tested.

We found that we had to keep the EthIR Beams as close as possible to the client PCs—especially in rooms that were brightly lit. On several occasions, when we moved the client PCs just a few inches, we lost the infrared connection.

In this sense, the EthIR LAN doesn't offer the true portability of radio-based wireless systems. The cost and speed may offset this liability.

Clarinet Systems EthIR LAN Switch, Model ES208. List price: \$1,279. **Clarinet Systems EthIR Beam LAN access unit.** List price: \$60. Clarinet Systems Inc., San Jose, CA; 408-501-0250; www.clarinetsys.com.



FAST INSTALL:

Run the included EthIR Switch Tool software to get your EthIR LAN started.

95 infrared drivers, along with an HTML document containing a compatibility matrix and information on obtaining the latest infrared drivers for your particular computer. Windows 98 users will need to install Microsoft's Direct Cable Connection (DCC) from the Windows

Lotus Delivers R5

Domino and Notes team up to give users the latest in groupware and delivery services.

By Tony Pompili

The combined Lotus Domino R5 and Notes R5 solution continues a legacy of providing a complete corporate groupware, application development, and application delivery system. The core solution has clearly been refocused towards the development and hosting of Internet and intranet applications.

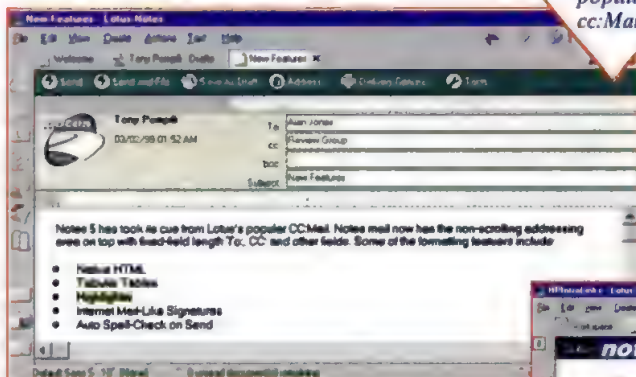
We tested the first shipping release of this version of Domino

variety of Internet applications, including IMAP, native SMTP, and CORBA/IIOP.

DOMINO DOMINATES

Enhancements to Domino are consistent with the R5 themes of Internet-awareness and simplified management. From an end-user's perspective, most of these enhancements are transparent.

STANDARD LOOK:
Notes mail still looks a lot like Lotus's popular cc:Mail.



and Notes. We tested the Notes client on a 233-MHz Pentium II PC running Windows 95 and the Domino Server on a dual-processor 200-MHz machine.

Though R5 runs only on Windows NT 4.x, 95, and 98, Notes and Domino are expected eventually to stick with Lotus tradition and run on a wider range of platforms. On the network side, the R5 solution can run on IPX/SPX, NetBIOS, and TCP/IP.

R5 enhances three specific areas of the Notes and Domino architecture. First, the Notes Desktop client has been upgraded to support more functionality and a wider range of Internet connectivity options. Second, Domino Designer has expanded support for Internet development and architecture, including Java and JavaScript. Finally, the Domino Server has become a serious platform for a

Messaging is still a central feature of Domino, and the big news here is that R5 has added native SMTP. Formerly, Domino used a specialized gatewaylike server (Domino SMTP MTA) to route Notes mail to and from the Internet. Under the new SMTP architecture, any Domino Server can route mail directly to the Internet.

Other useful new features include support for LDAP directory access. This enables the Domino R5 Server to make other LDAP-based public directories, such as the Exchange Directory, available to applications. Now, instead of relying on Notes Directory for message routing, a Domino developer can use other LDAP public di-

rectories to expand access to users and resources. On the flip side, Domino Directory (formerly the Notes Public Name and Address Book) is now available to other applications such as Microsoft Exchange or the Eudora mail client.

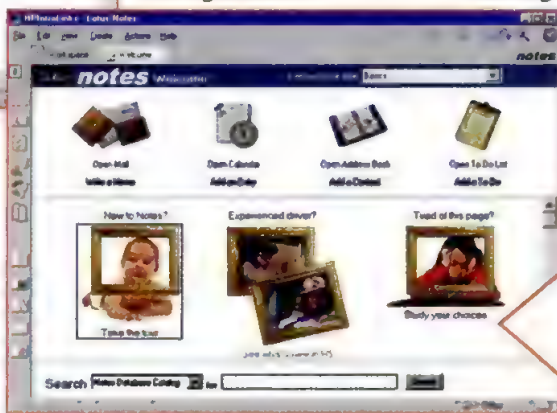
Domino Directory also includes the new Directory Catalog and Mobile Directory. Directory Catalog is essentially a compressed version of the public Domino Directory, but Mobile Directory is something truly innovative. In the past, administrators provided mobile users with full access to their organization's directory by replicating a large part of the public directory locally. The streamlined Mobile Directory can be as little as one-tenth the size of the actual public directory, but it will still provide all of the necessary information for a user on the road to send mail to anyone in the organization.

cludes an alphabet soup of application development and messaging tools. These include IMAP mail (Domino 4.6 already supports POP3 mail) and news server functionality. Developers will also find Common Object Request Broker Architecture and Internet InterORB Protocol (CORBA/IIOP) middleware.

ABLE ADMINISTRATION

In the past, maintaining Domino servers was an onerous task. The product's distributed environment offered great performance but little in the way of administrative ease. The new Domino Administrator is a management tool that makes administering your Notes applications and Domino servers easier by consolidating monitoring, managing, and troubleshooting into a single application. During testing, the improvement was obvious—moving a mail file from server

to server with Notes 4.6 took a half-dozen steps using several tools, but with the new Administrator, the same task was performed in one step.



NOTES GOES WEB:
The new graphical Notes R5 welcome screen has a home page look and feel.

For the security conscious, Domino R5 has made a natural transition to standards-based, certificate-based security, including X.509. (Domino was previously RSA certificate-based.)

Domino's application hosting has also been enhanced. You can now replace the Domino Web Server with Microsoft's IIS server if you choose. This eases the task of integrating Domino applications into existing Internet and intranet infrastructures.

The Domino R5 Server in-

Administrator's views also consolidate current status information into a single screen. For example, the Monitoring view lets you see the status of a several dozen servers and services on one screen. The Administration client has incorporated many features from Lotus's NotesView network management package, including up-time notification and real-time system topology graphics. You can also perform administrative duties with Domino Web Administrator.

INSTALLATION EASE

Lotus has improved the installation of all of its R5 products. Domino R5's new Weblike interface guides administrators through the straightforward process of installing basic services, and the new User Setup Profile lets administrators populate user desktops centrally.

As with Domino 4.6, Lotus will continue to ship three versions of Domino Server: The low-end Domino Mail Server for messaging only; the Domino Application Server for developing custom Notes and Web applications; and the Enterprise Server, which lets you cluster

Domino servers and run multiple instances of servers on a single box. The Domino Server console is still a text-based terminal window with few formatting options or controls.

For developers, Notes R5 introduces one of the most impressive features of the new release. Domino Designer succeeds at integrating Notes and Web tool elements into a single application. One piece of Domino Designer, Outline Designer, aids in organizing Web pages and Notes elements logically, which makes assembling large, complex applications easier.

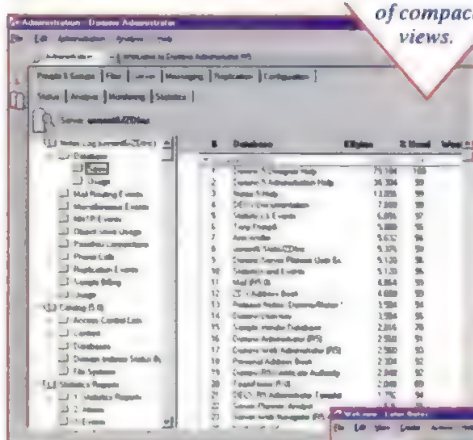
As with previous versions of Notes, this new release stores all of the distinct elements of an application (including @Commands, Java, LotusScript, and Web pages) into a single file. Historically, this makes administration and distribution of applications fairly simple. Similarly, Domino R5 uses a common set of application services such as routing and replication. Domino Designer can inte-

grate these services into one application as well.

Under the hood, Lotus has greatly increased the supported object structure. Now, Domino and Notes run both server- and client-based JavaScript and Java.

To ease the complexity of making Domino applications work with both Notes clients and Web browsers, Notes documents are now

TROUBLESHOOT:
Domino Administrator simplifies monitoring with a variety of compact views.



stored as native S/MIME. There are also new Notes objects, such as Framesets, that allow developers accustomed to working with individual Web pages and frames to build Notes Web applications.

Notes R5 with or without a Domino server. If you want to use standard Internet mail, the Notes R5 client can work with a POP3 or an IMAP4 server (new to R5). You can even set up Notes to work with

both an Internet mail server and a Domino server simultaneously. As always, you can view Web pages within

Notes using either Notes' built-in browser or via Microsoft Internet Explorer 4.0.

New to the client is the ability to use LDAP directory services directly, independent of a Domino server. You can use public directories such as Yahoo! to address messages to Internet users.

The Notes R5 inter-

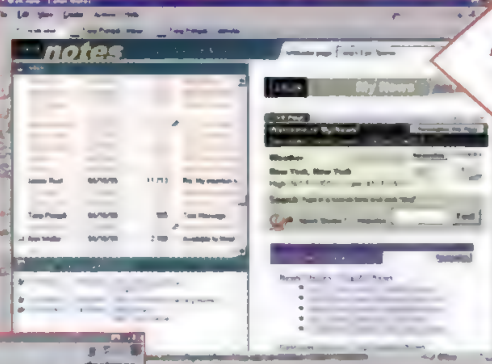
we experienced some initial problems. Web browsing from within Notes proved difficult, as Web pages often didn't load correctly or completely. We were unable to open our calendar from the welcome page, and the speed of the program was a concern. These issues turned out to be glitches that were easily resolved with an upgrade to the shipping version. In general, we found the client to work as well as the server components. The only remaining issue is that Web browsing from within Notes still takes considerably longer than browsing through a standalone browser.

WHO'S GOING FOR R5

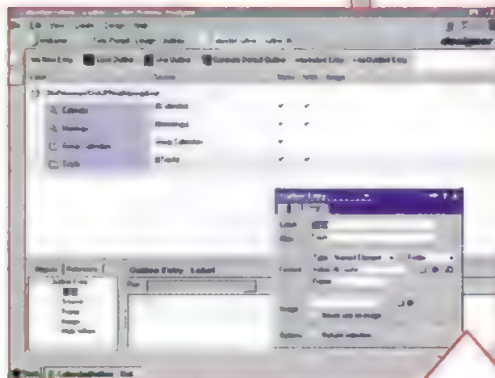
In the Lotus Domino R5 and Notes R5 combined solution, Lotus has delivered a rich array of Internet and intranet tools to keep its current customers inter-

NOTES FOR YOU:

The Notes R5 Desktop allows you to personalize your own welcome page with Notes components.



ested, even with the onslaught of Microsoft Web delivery and development tools. Domino and Notes application management should be an enticement for



THE NOTES DESKTOP

On the desktop side, the Notes R5 client includes many of the same nimble attributes as the new Domino Server. As with Notes 4.6, you can use

UNIFIED INTERFACE:
Domino Designer integrates multiple tools in one view.

face looks fresh and updated. Lotus has replaced the classic Notes workspace with new bookmarks that let you organize Notes databases, Notes documents, and even Web pages under tabs and drop-down menus. The new welcome screen adds a Web page feel to the workspace. Icons provide access to your calendar, mail, and to-do lists.

We first looked at the client when it was still in beta, and

Web applications developers because of simplified application storage and management tools.

All in all, Lotus Domino R5/Notes R5 is an impressive release, especially for those organizations that find working in the Internet standards space a necessity, not an option.

Lotus Domino R5/Notes R5. List Price: Domino Mail Server, \$695; Domino Application Server, \$1,795; Domino Enterprise Server, \$4,995; Domino Designer, \$495; Notes Desktop Client, \$55; Full Notes, \$69. Lotus Development Corp., Cambridge, MA; 800-205-9933; www.lotus.com.

Toshiba jumps into server market.

COMPUTERS: "The Magnia series is a perfect example of how we can provide the latest and most powerful technology

that customers can benefit from in the future," said Friederichs, vice president of marketing, TAIS, CSB. Magnia 7000 server offers a combination of performance, scalability to address the enterprise

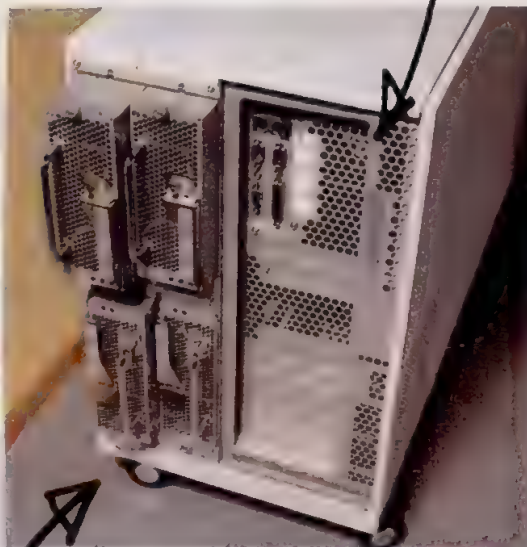
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Sony Mavicas Are Winners

By Bruce Brown

The Digital Mavica cameras, from Sony Electronics, have many endearing qualities, but they are a huge success primarily because their captured images are stored on standard floppy disks. The line includes the Sony MVC-FD81, winner of an Editors' Choice award (in our roundup of digital cameras, "Closing the Gap," January 19, 1999).

The only disadvantage of using floppy disks for image storage is their 1.44MB capacity, which restricts practical resolution limits. If Sony sold a megapixel Mavica, only one un-

compressed image would fit on a single floppy disk; in fact, the FD81 and FD91 cameras have an uncompressed mode that fits one image per disk, even with the cameras' maximum 1,024-by-768 resolution.

Many respondents complained about lack of detail in images captured with the FD81, but an equal number wrote that they were aware of and didn't mind the lower resolution trade-off in favor of easy storage. Several readers mentioned that they no longer use high-quality conventional film cameras, in favor of the Mavica.

We remain impressed with the



A SNAP: Many users appreciate the ease of use of the Sony Mavicas.

large, bright 2-inch LCD viewing panel on the FD81 and its long battery life with standard lithium ion batteries, though only a few readers mentioned those features. And though several men-

tioned the convenience of taking short MPEG film clips, no one mentioned the camera's audio recording capability.

A surprising number of respondents have bought more than one Mavica and look forward to next-generation models. More than one person mentioned our own wish-list item: a Digital Mavica

camera with 2-megapixel resolution using Sony HiFD 200MB storage media. It remains to be seen whether this format will take off in the marketplace, however, and Sony will not comment about combining the two technologies.

With several high-quality megapixel cameras now selling for less than \$500, the fact that Sony can sell submegapixel cameras in great quantities underscores the importance of the universal storage solution and the element of simplicity. In this respect, the Sony Mavica line is similar to the 3Com Palm handhelds: Both demonstrate that if you make a product that adequately uses techniques or technologies that are quickly understandable, consumers will buy it, even if more advanced and less costly alternatives are out there.

CompuServe 2000: Progress?

By Kathy Yakal

As expected, the new incarnation of CompuServe was met with a chilly reception by some long-time users. Online posts decried long waits on customer-service phone lines, problematic installations, and the loss of POP3

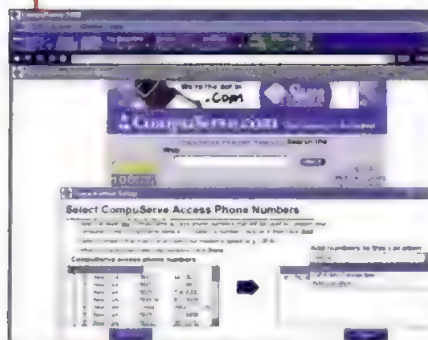
interactive forums and services that have been its trademark for 15 years. CompuServe 2000's new look sometimes makes you think of listening for circus music. Further, some features of previous versions can't be found in CompuServe 2000—for example, reserved handles and profiles, FTP and telnet, and Macintosh and Windows NT support.

Although some disgruntled users might wish that AOL management would just put CompuServe out of its misery, apparently there are no such plans for this in the near future. No one will be forced to upgrade to CompuServe 2000, though. And according to the official line, current versions will continue to be supported. Rather than being a step toward phasing out, CompuServe 2000 is intended to represent a new commitment to users. If you're wary, you can preview CompuServe 2000 for two months and return to your old service afterward if you wish, retaining your original user ID or personal address.

Clearly, a lot of people want a

simple, highly graphical, proprietary service. AOL's success is due to more than aggressive marketing. But dedicated CompuServe users may not cozy up to this new version, 56K access or not.

Many long-time users would like to see the guts of CompuServe preserved in a structural fashion; as long as previous versions are supported, that's still happening. CompuServe 2000 is also a good compromise for new users, especially those who find AOL a tad cloying.



GRAY AREA: CompuServe 2000's access numbers trail demand.

connections. CompuServe 2000 was even dubbed "AOL Jr." by one veteran user.

The point is well taken. The new "broad-based access to lightning-fast 56K connections" is a strong selling point—unless you're in an area where access numbers have not kept up with demand. And though CompuServe has retained the serious

www.secondlooks.com

Tell us what you think... How do you like the new products you're using? Second Looks is your forum for feedback. Join us online to tell us about your experiences. We discuss a different new product each week and summarize your comments here. Following are some of your comments from our discussion of The Sony Mavica MVC-FD81 and FD91 cameras.

I have one and I love it. You can't beat the price of the floppy disk as storage medium. And using the camera is so easy. If I wanted ultrahigh resolution, I'd use a film camera, but I sure like being able to edit and improve my Mavica pictures right on the PC. What's not to like?

—Phil M.

The FD91 is a fabulous camera, but floppy disk storage has clearly reached the end of the line. I suppose Sony will try to use its new 200MB floppy disk technology in a next-generation Mavica. I'll be interested to see what Sony comes up with, but I'm not convinced it will work.

—Henry Ellingworth

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Too Big for the Little Guys?

We're endlessly familiar with the rampant success of Yahoo!, Amazon.com, and eBay, and the stories of the people who made them successful. But what is life like for the smaller guys, the ones who run Web sites with discussion forums for topics they love? Out of the thousands of special-interest sites, I've

spent time talking to the proprietors of two that I spend time on. Wayne Miller runs Badger Pond (www.wwforum.com) and has a common heritage with Deb Suran at The Musicians and Instrument Makers Forum (www.mimf.com). Both were sysops on the old Crafts forum on CompuServe, which had a wonderful woodworking section, and both were disillusioned by internal politics and CompuServe policies. Both, too, were inspired by the possibilities of the Web.

Miller had a successful general contracting business but tired of hefting a 24-oz. framing hammer every day, so he switched to building custom furniture. He got some books on HTML, started researching Web discussion software, and built Badger Pond. It's a moderated discussion group, and Miller polices rigorously against nonwoodworking postings, commercial messages, spam, and flames. Disgruntled former Crafts forum members started turning up, as did refugees from the rec.woodworking newsgroup, tired of the flame wars. Also, Miller insists on full names, not handles, so posters can't hide behind the often-abused veil of anonymity. Postings in MIMF are even more content-rich and on-topic than at Badger Pond. It's an incredible resource to the aspiring instrument maker.

Because Badger Pond is HTML-based, members can post photos with their messages, and often include pictures of their handiwork. As the group has grown, Badger Pond has evolved into one of the most informative and useful woodworking sites on the Web. It has also developed a unique sense of community, even though the membership (2,000 strong) is worldwide. Ponders, as they call themselves, care about one another, offer advice and counsel, and get together socially at woodworking shows. Newcomers are always welcomed, however, and a beginner's work is praised just as highly as the most expert projects.

Suran was a builder of hammered dulcimers, a singer, and a teacher. She built MIMF because of her love for instrument building and because there was no good place for instrument makers to exchange information. Like Miller, she insists on full names and accountability for messages.

Both discovered quickly that hosting costs money, and they needed advertising revenue to offset their expenses. MIMF also accepts PBS-like member contributions, and Ponders have helped Miller defray the cost of a new server. Both get commissions on book sales through their Amazon.com links. Forum hosting scripts are incredible resource hogs, and even moderate message traffic can overload an ISP's host machine. Both have switched hosting providers more times than they would like. Suran has written up some of her tale of woe at www.forumhosts.com/hosts.htm.

Too much success can be a bad thing. At 1,100 members, MIMF is at the limit of what its server can handle, and Suran asks that you not browse the forum (unless you're an instrument builder in need of help!) until perhaps a month from now, when she'll move the forum to a dedicated server. Badger Pond, meanwhile, is already on a two-processor machine, and Miller is weighing his advertising options.

Is hosting a Web site a full-time job, and does it pay? Miller gives an emphatic yes, saying that Badger Pond has turned the corner, and that with ad revenue, his additional Web site design and hosting business, and other, related income, it's a going business that he intends to be in for the long haul.

To the same question, Suran says, "Ask me again in six months. If I'm here, I made it. If not, it simply didn't generate enough revenue to make ends meet." She currently works in IT at a local hospital. With the forum, it's like having two full-time jobs. But MIMF covers its own expenses, not hers. Although some of the tool companies advertise on Badger Pond, they have yet to discover MIMF.

Love of or expertise in a subject is clearly not the magic ingredient when it comes to running a special-interest site. Finding the balance between members, advertisers, server size, monthly costs, and message traffic is a difficult task—but a worthy and rewarding one for the benefits the site brings to members.

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Film Is Dead, Part II

Clear patterns are emerging from the digital-camera battle between Kodak and Olympus. Only the consumer is winning. There's no doubt that these two players are the leaders in the field, despite the fact that Sony actually sells more cameras, and that Nikon's two-megapixel device was the camera du jour at

Hannover. Sony Mavica's sole appeal is the fact that it uses floppy disks as its storage medium. This is a great concept for low-res pictures, but the trend is toward higher resolutions.

Make no mistake, Kodak and Olympus are the two companies seriously battling for this business. The basic differences between the two systems are the user interface and optics. The best under \$500—and the one I always recommend—is the Kodak 210 Plus. It takes a credible picture and has the absolute best easy-to-use controls.

Olympus begins to shine when the price goes up and the resolution increases. The original Olympus 500 and 600 series, which should have come down in price substantially by now, both have huge accurate lenses and simply take noticeably sharper pictures. Olympus also has various snapshot printers that eliminate the need for a computer.

I recently took a new Olympus D-400 to the Hannover Fair and compared its pictures with ones taken by a Kodak, and there was no comparison. The D-400 pictures were much sharper. But the D-400 has problems of its own. The user interface is incredibly cryptic, and you can't operate the camera without checking the manual over and over to figure out what all the odd symbols are. Also, many of the settings don't "stick." There's a spot-meter option, for example, but when you power down the camera it's reset to area metering. As a Pentax Spotmatic user from years ago, I prefer spot metering.

The images from the D-400 are sharp, but the contrast isn't as good as the Kodak's. You can fix this, though, with any photo-editing program. In fact, in the program I use, Thumbs Plus, the "General Enhancement" trigger will perfect any D-400 image that seems a little flat. Kodak has had the edge in this regard since the release of the classic Kodak D50 camera, which I still recommend to people who need a cheap camera for Web images. The D50 was overshadowed by the miserable D120, which would misfocus for no apparent reason and had numerous engineering flaws.

The flawed D120 actually opened the door for Olympus and others. But Kodak jumped back with the 210 and its near-perfect user interface. The newer 1.6-megapixel Kodak 265 has an amazing user interface and incredible features, such as automated time-lapse photography. And the camera can run programmed scripts downloaded from the Web for various functions. An amazing camera.

Kodak's use of mini-flash memory as opposed to Olympus's SmartMedia is a clear advantage, unless the SmartMedia people get their act together. I've seen 128MB mini-flash cards, and the 340MB IBM hard disk is in this format. Meanwhile, getting a 16MB SmartMedia card is difficult. When I took a few hundred pictures in Europe, I was constantly swapping 4MB and 8MB SmartMedia in and out of the D-400. It was tedious.

One thing that stunned me about the D-400, though, was the battery life. I brought two sets of rechargeable nickel hydride batteries. Any Kodak camera will blow through a set of these batteries in maybe 50 pictures, depending on how much you use the LCD and flash. I never did go through a set of batteries with the D-400. Never! I shot hundreds of pictures and couldn't burn out a set. This was after two weeks of nonstop shooting.

Another difference between Kodak and Olympus technology, besides power management, is the way the CCDs are loaded. The way the Kodak loads the CCD minimizes blurring or camera motion. The Olympus images are susceptible to camera motion and the blurring of fast action. The fact that an Olympus image is so much sharper makes up for this, but you do have to hold the camera very steady. The other trade-off is that the Olympus cameras will take better night scenes. If you like neon lights, get one.

Meanwhile, Olympus has upped the ante with the 2.1-megapixel Olympus C-2000—a beauty in a new form factor. And it adds the benefit of saving pictures as TIFF files. The war between these two companies is driving the entire digital camera business. I hope they tie at the finish line. A photo-finish. Click.



The war between Kodak and Olympus is driving the entire digital camera business. I hope they tie at the finish line.

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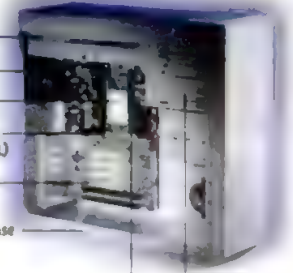
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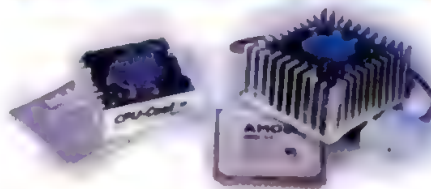
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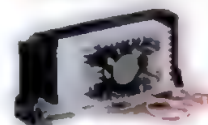
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John C. Dvorak's



INSIDE TRACK

Whither Windows CE Dept.: Microsoft is not about to give up on making Windows CE some sort of standard in some sort of market. The latest word is that the company is taking the **rather nice little OS built into WebTV** and gutting it to replace it with Windows CE, making the future WebTV a true Win CE-based set-top box. This plan has **disaster** written all over it. The second iteration of WebTV is almost a work of art, the way the system self-configures and operates. Microsoft cannot improve it. I'm reminded of FrontPage, a product Microsoft bought and then diddled with until the program became almost unusable. **Simplicity and elegance** turned into **complexity and spaghetti code**.

Some outsiders believe that it has become part of the Microsoft culture to make products **more and more complex** until they become unusable. There's evidence that this phenomenon takes place because there are **no rigid controls put on the code base**, and large groups of coders hack away at software subsystems in a never-ending effort to improve the code.

The cycle at Microsoft becomes one whereby a product starts out functional, becomes improved until it's excellent, and then further improved to make it more complex until finally it becomes unusable. Windows NT is the most glaring example, as the company struggles with **excessive code size and creeping featurism**. Thus Microsoft's best strategy is to develop as many new products from scratch as it can. I suspect that as Microsoft comes to grips with the macro dilemma and the complexity of Word and Excel, we will eventually see an **all-new word processor** and spreadsheet program within the next 24 months.

Back to the notion of the **CE-based set-top box**. The latest thinking in the cable business is that consumers will buy set-top boxes the same way they buy computers: each with various functions and features depending on the price. The cable company interfaces with these various boxes and charges the user according to the features available via the box and those actually used. Each box will have a unique interface as supplied by the vendor. A Windows CE box, for example, would have a familiar **Windows look and feel**.

The thinking is that these boxes will be bought, sold, and upgraded in such a way that they will become a new profit center for the cable folks, since they would also be dealers for these devices. This entire scheme seems to have evolved from the need to **rethink cable services** after the adoption of the Open Cable Initiative, which lets consumers pick and choose their own set-top boxes.

On another Microsoft front, the creative little program called ICQ, which was acquired by AOL, keeps tracks of "buddies"

on the Internet. You automatically log onto a server when you log onto the Net and people know you're online. Look for Microsoft to **go after** the ICQ business with MSN Messenger, which will be distributed to both **Hotmail and MSN customers**. Your Hotmail name will be the name that appears on people's buddy lists. There will apparently be a lot of cross linking, as IE 5.0's Outlook Express contact list will also be used as a trigger for buddy lists.

According to some sources, Microsoft is looking into unilaterally using ICQ's **open architecture** to make it possible for MSN Messenger users to see ICQ buddies, too. The idea is that MSN Messenger users could see everyone, but ICQ users would have to join the MSN Messenger system to see all those Hotmail users. Once all users were on both ICQ and MSN Messenger, Microsoft would **slowly evolve** its product to **kill** off the other. Exactly how the company expects to profit from this is a mystery. But Microsoft will have the satisfaction of **sticking it to AOL** as a last "thank you" for buying Netscape.

Here Comes the 42-Volt Car Dept.: Auto researchers impressed with the ability of computers to operate automobiles have been working on two technologies. One is a **networked car**, whereby the network controls the vehicle's functions so that large wiring harnesses become a thing of the past. The other is a 42-volt system designed mostly to **control the valve train** and other functions of the engine electronically, rather than mechanically. In other words, good-bye camshaft.

I find the 42-volt system idea intriguing, because an electronically controlled valve train could be adjusted on the fly for optimal performance. Of course

I assume that an **OS malfunction** could easily result in the engine blowing up. And when the car drive-by-wire network goes down, you can expect the brakes will stop working. Ouch.

USB, USB Everywhere but not a Drop to Drink Dept.: This is another one of my projects that requires user feedback. I've had nothing but **poor luck** with my USB devices. For the most part they have to be powered up after the computer boots, or either the computer doesn't boot or the devices don't work. Doing some simple research in newsgroups reveals all sorts of USB horror stories that nobody is reporting.

The Reverend Dennis Hoffman wrote to me about a **USB debacle** involving HP's new line of USB scanners. I had problems with a Visioneer scanner and USB. He suggests some newsgroup searching or a look at the HP Community Forum for details. I think **this is the tip of the iceberg**. There's something wrong with USB in its current implementation, and I'd like to hear your stories. I can't yet say what the source of the problem is. Maybe we can find out. Send me e-mail at USB@dvorak.org. **PC**

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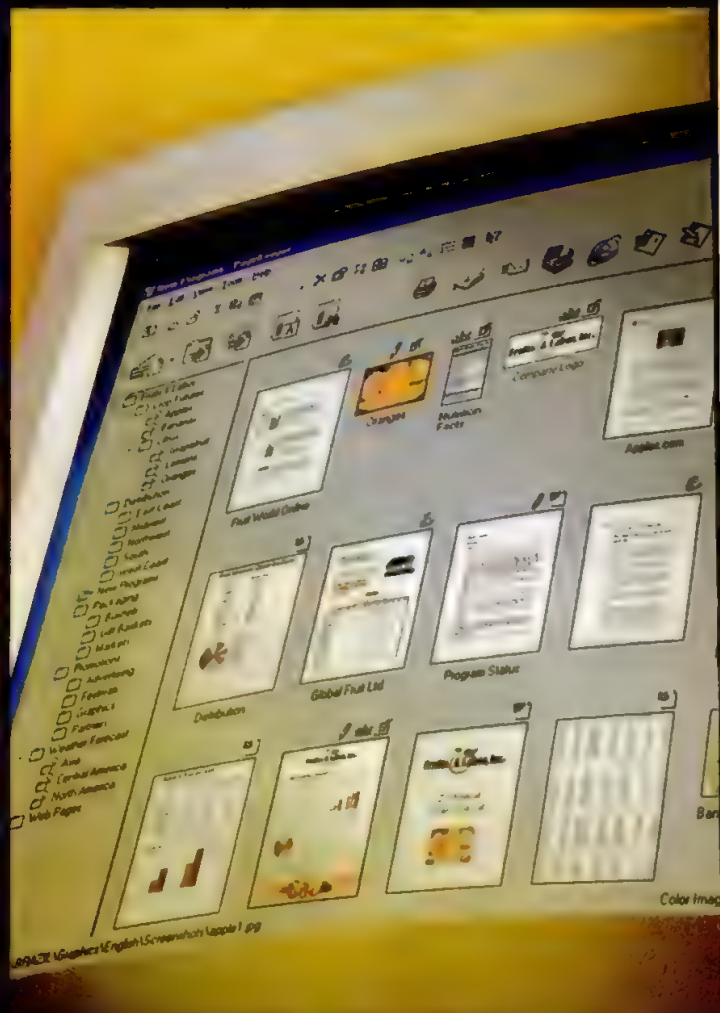
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Web Apps: Yes, But...

Microsoft? History. Symantec? Intuit? Lotus? Fuggedaboutem. Because, the seers tell us, pretty soon we're not going to be buying much of that pricey shrink-wrap software that we've spent so much money on over the past two decades.

Instead, we're going to start using apps on the Web. Why clutter your hard disk

with gigabytes of applications; why go through an upgrade every few months; why spend all that money? Why not just use these quick—and usually free—applications for your work?

Sounds good to me.

I take no joy in watching how fast the hard disks in my PCs are filling up. I don't like software installs where I'm told that a typical install will take about 125MB—but that I can cut corners and get a compromised, "compact" installation of "just" 58MB. Heck, I could fit everything I've ever written into 58MB! How could one software package possibly take up so much room?

And I'm not fond of spending \$100 to \$300, sometimes more, for software titles and as much as half that much more each time for upgrades. (Sure, I don't *have* to upgrade. But with the need to keep my software versions in sync with my colleagues' current versions—lest we have trouble exchanging files each of us can read—I've learned the hard way that most, if still not all, application upgrades are worth the pain. Even when there's not much gain.)

So I'm ready for Web apps. In fact, I use several.

One of the obvious categories for online applications is online calendaring, which makes it easy to share information over the Web with selected friends, family, and colleagues. There are several good Web-based online calendar apps (see First Looks, March 23, 1999, or the online version at www.zdnet.com/pcmag/firstlooks/9902/f990226a.html) of which I like When.com best. I'm not alone; the people at America Online liked it so much that they bought the company in early April. When.com will continue to be available to all Web users, not just AOL subscribers.

A quick look at When.com shows what's good and what's not so good about the idea of Web apps.

In the best tradition of the Web, When.com has a bright, easy-to-use interface. It asks for a one-time sign-up and includes a clear, unambiguous privacy policy, under the TrustE standards.

Once you've signed up, you go to a very attractive daily schedule view. With a click you can jump to

weekly or monthly views. Adding appointments is easy, though the tools for setting up recurring appointments, reminders, and the standard time interval shown during the day aren't quite as sophisticated as those in the name-brand scheduling applications. And printing out reference copies of your schedule is...well, that capability is pretty much nonexistent. You can use your browser's File | Print option, but that's it.

But look at the benefits you get: You can create group calendars with the click of a mouse button. Name the people you want to have access to the calendar and it's done. You can set up meetings and notify others of them with just a few more clicks.

And best of all, if you live in one of the 50-plus metropolitan areas When.com tracks, you can find and add to your personal calendar a wide range of concerts, art exhibitions, theater and dance presentations, new book and CD release dates, videocassette releases, wine tastings, trade shows, sports events, and much more—even upcoming IPOs and quarterly earnings reports!

Pretty nifty. And free, thanks to When.com's advertising and (mainly yet-to-come) e-commerce offerings. (It'll be easy to buy tickets for events you've selected, for example, or to order new books and CDs via a When.com link. But as I write this, that's not yet implemented.) And it would be quite impossible without the up-to-date-ness possible with a Web connection.

Not all Web apps will be free—or rather, subsidized by on-site banner ads and e-commerce. A good example is the Qwest Fax service available on Netscape's Netcenter, at <http://home.netscape.com/qwest/fax>.

For years I've relied on Symantec's WinFax, but in Versions 8.0 and now 9.0, it's just gotten too big and ponderous, the victim of rampant feature-itis. What's more, I no longer send as many faxes as I once did; e-mail has pretty much taken over. I don't want to devote a gazillion megabytes of my notebook's hard disk to WinFax, nor do I want to keep buying its upgrades.



You've gotta decide which tasks fit the pattern of Web-based usage and which demand an application that sits on your hard disk.

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Jim Seymour

So I'm a subscriber to the Qwest Fax service on Netcenter. I can send all the faxes I want for 15 cents per page, with a \$2.95-per-month minimum. They look great and are delivered quickly—and I can do it all on the Web.

For me, Web-based faxing makes a lot more sense than using full-blown software installed on my PC. (I could also receive free Web-based faxes at sites such as eFax.com. But the last thing I want is to encourage people to send me more faxes, in any form, and I don't want to get locked into having to view these incoming "fax-mails" with a software viewer, necessary for eFax users.)

There you have two of the three big issues in Web-based apps. First: Is your pattern of usage consistent with the nature of Web-based tools? In other words, do you do things every day, such as word processing, for which you want a locally installed, full-strength program, or is a Web-based tool sufficient for you?

Second: What will you give up to get the advantages of a Web-based tool?

The third question has to deal with our episodic connections to—access to—the Web. Someday, most of us will have a full-time (*persistent*) Web connection: Our PCs will always be on, our Web links always live, so we'll be able to use Web services anytime, anywhere. But in the Real World, our Web connections are still wired, intermittent, slow, and hardly rock-solid in terms of reliability.

Sure, it's great to be able to access and update your calendar instantly when you're in St. Louis and you forgot your calendar in Austin. But what if you're sitting in your office in Austin and can't get on the Web? Or your PC or network is down? And you don't remember whether the big pitch today at Client Gigante is at 2:00 P.M. or 3:00 P.M.?

You've gotta decide which tasks fit the pattern of Web-based app usage—and day by day, we'll see more of these apps, with ever richer functionality—and which really demand an application that resides on your hard disk.

Fair warning: That decision is getting harder every day. **PC**

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Making the USB Connection

Out of IRQs and out of patience, I decided the time was nigh to move to USB. Universal Serial Bus is the three-year-old, almost-there standard for connecting mice, keyboards, scanners, and so on to your PC. The future is glowing. The present is somewhere between interesting and useful. Here's what I found out:

USB works (mostly). Many USB devices work as advertised: You plug them in, you install their drivers, and they run—usually. You can add and subtract USB devices on the fly, and you don't have to power down your PC. USB communications devices such as videoconferencing cameras may be more troublesome. (For information and links regarding USB technology, go to the source: www.usb.com.)

The excuses sound the same. Vendors who aren't yet making USB accessories all have similar lines of reasoning: Much of the world still runs Windows 95, a USB-hostile platform, and stores don't like to stock additional USB-only boxes.

Keyboards and mice are plentiful. Logitech and Microsoft keyboards and mice plug in and work just fine. Ditto for a Logitech force-feedback joystick. The attraction of USB is that along with your vanilla keyboard/mouse combo you can add a trackball, a tablet, or kids' devices. Those will come later this year.

Communications is a go. Upgrading to the newest version of Traveling Software's LapLink Pro file-transfer program with the optional USB cable ended one of life's little hassles: unplugging your PC's printer to plug in the yellow PC-to-laptop LapLink cable after first (in theory) turning off your PC (www.travsoft.com). The Anchor Chips EZ-Link Instant Network works similarly well for those not put off by products called "EZ."

USB cameras and video cameras abound. You'll have no problem finding a passable array of digital cameras with USB connections (Kodak leads here). The SanDisk USB ImageMate reads CompactFlash memory cards from cameras lacking USB. There's an abundance of USB-based videoconferencing cameras. But an Intel USB ProShare camera took two days of debugging to work with Microsoft NetMeeting. The solution: installing the software three times. Comm devices are like that. I was tickled to death with the Belkin camcorder-to-USB video grabber; think of it as a 1999 version of the Snappy device.

Scanning wasn't what I wanted. You can get a number of USB flatbed scanners, but I already have one

that uses SCSI. There are two specialty scanners I dearly love, the sheet-fed Visioneer PaperPort Strobe and the business card-reading Corex CardScan, and Visioneer (www.visioneer.com) just announced its new USB product line (Strobe Pro). The CardScan still requires a parallel or serial interface, and it's unclear when the device will get USB.

Ink jet printers are available—not laser. Among Canon, Epson, HP, and Lexmark, there are seven USB ink jet printers. There are hardly any lasers and no multifunction peripherals.

Mass storage needs more breadth. The 100MB Iomega Zip Drive has a USB version, but not the more desirable Zip 250 or the 1GB and 2GB Iomega Jaz Drives. With those, I could swap one device easily among several desktops and portables.

Audio benefits are uncertain. USB promises purer sound, because interference inside the PC affects analog but not digital signals. I got good and very good sound from the Altec Lansing ADA70 and Microsoft Digital Sound System 80 speakers, respectively, but the Altec speakers occasionally hissed when my PC was in suspend mode, and I was able to unsync the hardware and on-screen controls temporarily on the Microsoft speakers (theoretically not possible, Microsoft says).

UPS proves a pleasant surprise. Nobody uses uninterruptible power supply auto-shutdown features on desktops, because they don't want to give up serial ports for the control cables. The APC BackUPS-350 or -500, from American Power Conversion, gets around that neatly and gives you orderly shutdown of your PC even if you're not around. It's not perfect, though: Unnamed open files won't be saved.

If you're running out of IRQ lines, PC slots, or ports on the back of your PC, but you don't want to buy new USB devices, consider a USB-to-parallel or USB-to-serial adapter from vendors such as Belkin or Entrega. And it needn't be USB: SCSI lets you connect up to six devices such as scanners and drives. If you want to attach an Ethernet-only cable modem or DSL modem, try a USB-to-Ethernet converter. All these accessories run \$50 to \$100. **PC**



Many USB devices work as advertised: You plug them in, you install their drivers, and they run—usually.

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POLISH it

Just because you're a small business doesn't mean your Web presence has to look small-time. Promoting your site through banner ads and targeted e-mail can be very effective in driving traffic. Your site can also be a revenue generator, either through e-commerce sales of your own wares or as an affiliate, generating leads for other businesses. Presenting a professional look is sometimes just a matter of making sure all your links work and your graphics aren't too large. We review the Web-based—and for the most part, free—services that provide these finishing touches to help you compete in the big time. *page 129*



BUILD it

Building a great Web site in 1999 means creating an interactive experience for your visitors. You need a flexible and scalable base on which to mount dynamic, database-driven Web pages created on the fly. These products can not only help you build Web-based retail applications for selling products and services, they can also help you build intranet solutions for business-to-business transactions. Some are for programming experts only, while others employ a more user-friendly approach. We review five leading tools from major vendors such as Microsoft, Oracle, and Sun that will help take your site to the next level. *page 147*



SERVE it

The foundation of your Web business is the operating system and Web server it's run on. Which of these should you choose to be your platform for success? We take a critical look at Linux, Microsoft Windows NT, and Sun's Solaris to evaluate their individual strengths and weaknesses as Web platforms. We also review the major Web servers that run on each platform—Apache, Microsoft Internet Information Server (IIS), Netscape Enterprise Server, and Sun Web Server—to help you choose the right combination for your needs. *page 163*

eat site

T

here's no doubt about it: The Internet is transforming the way the business world works. Over the past few years, the number of small businesses with Web sites has grown by nearly 110 percent. By 2001, there will be some 4.3 million small businesses on the Web, according to a recent

IDC Research report. More important, businesses are making money online. Last year, more than \$12 billion worth of goods changed hands online, according to IDC.

For most companies, the question is no longer whether to set up a Web site but rather how to create the best site for your business. In this special report, we look at the tools you need to make this happen. Our story covers a lot of ground, from the latest WYSIWYG authoring tools to high-end developer tools for building Web-based applications to services that put the finishing touches on your site so it looks professional. Finally, we review the most popular platforms for hosting your site.

By Michael J. Miller
Illustrated By Tom White

FIRST THINGS FIRST

Of course, before buying anything you should first decide what you want to accomplish with your Web site.

If you want to start slowly and just get a toehold on the Web, you can create a basic site—a sort of electronic brochure—without spending a lot of money or time. By having a simple online presence, you can enhance awareness of your business and broaden the potential market for your goods or services. Such sites typically consist of little more than a few pages of static HTML and images. To create these sites, you may not even need a separate HTML authoring

program. Today's word processors, low-end publishing packages such as Microsoft Publisher 2000, and even the online authoring tools at community sites such as Homestead and GeoCities (reviewed in "A Web Site of Your Own," April 6, 1999) may suffice.

But if you want to add pages to your site or update it regularly—and trust us, you will—you're better off with a stand-alone authoring package, such as Macromedia's Dreamweaver 2, Microsoft FrontPage 2000, or NetObjects Fusion 4.0. These packages not only give you templates for creating basic pages but also offer the flexibility to design a site with the customized, professional look you want for your business. And they provide the tools you need to manage your site once it is up and running. You'll find complete reviews of these tools in "Design It," in this issue.

You may also want a dedicated tool for creating graphics for your Web site. Although many professionals use tools such as Adobe Photoshop, most business users would be better off with a simpler product such as Adobe ImageReady, Adobe ImageStyler, Macromedia Fireworks, Microsoft PhotoDraw 2000, Hemera Technologies' NetGraphics Studio2, or NetStudio Corp.'s NetStudio 1.0.

SELLING ON THE WEB

It's one thing to put your business online, but actually doing business online is a whole different matter. To sell goods or exchange data with business partners via the Web, you need a more sophisticated Web site. This is no longer the exclusive domain of companies such as Amazon.com. A company of virtually any size can have a Web storefront. In previous issues, we looked at packages specifically designed for small (November 17, 1998) and medium-size businesses (January 5, 1999). These solutions are ideal for retail businesses that want to start selling on the Internet without a large up-front investment.

Larger companies that want more sophisticated and cus-

tomized database-driven sites will have to develop their own Web applications using tools such as Allaire ColdFusion 4.0 and Microsoft Visual Studio 6.0 Enterprise Edition (reviewed in "Build It," in this issue). These tools aren't for everyone; they require some expertise and a larger investment of time and money. In exchange, though, you'll get exactly the Web site you want.

PICK YOUR PLATFORM

Just as the size and complexity of your site determine the tools you need, they can also determine where you want your Web site to live. There are many options for hosting your business's site.

If you have a small site—one you've created mainly with WYSIWYG authoring tools or one of the small-business storefront products—your best bet may well be to let someone else host the site for you. Almost every community now has at least one local Internet service provider (ISP) that will host Web sites and may also help out with building and maintaining them. In addition, nearly all of the major national ISPs offer site hosting, starting at around \$20 per month (for more information, see "At Your Internet Service," April 20, 1999); a number of companies provide dedicated hosting services.

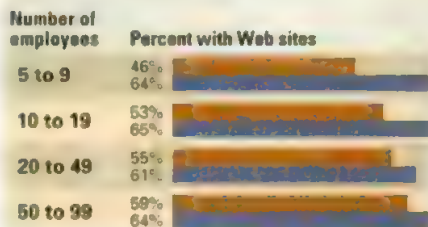
If you prefer to host your own site, you'll

SMALL-BUSINESS WEB SITES

Currently, about 2.3 million small businesses (fewer than 100 employees) are online. Most have relatively simple sites that consist of only a few pages, but that should change soon, according to a recent survey of 184 small businesses, as more ISPs offer easier, turnkey commerce solutions.

Number of sites

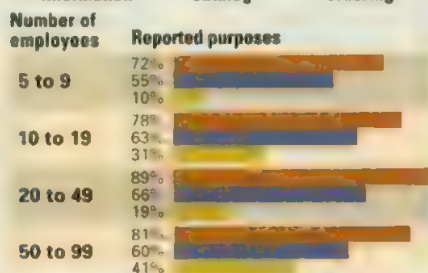
■ 1998 ■ Planned by 2000



Source: Cahners In Stat Group

Purpose of sites

■ General information ■ Product catalog ■ Online ordering



have to do a little more research and spend more money. You'll probably want redundant servers, a fast Internet connection, and an IT staff ready to supervise the site at all hours. To host a site, you'll need the appropriate server hardware, an operating system, and Web server software. In "Serve It," in this issue, we test some of the popular Web hosting platforms—Solaris/Net-scape, Microsoft Windows NT/IIS, and Linux/Apache—to see how they stack up.

Creating a site, though, is only the first step. To ensure its success, you have to get potential customers to your virtual

doorstep and then keep them coming back. There are many services out there that can help (these services are reviewed in "Polish It," in this issue). Search-site registration, ad banner exchanges, and online discussion and search capabilities give your site the finishing touches and visibility that will steer browsers in your direction.

They say if you build a better mouse-trap, the world will beat a path to your door. Similarly, if you build a better business Web site, the world is only a mouse click away.

PC EDITORS' HOT LINKS

www.pcmag.com/hotlinks

Not surprisingly, the Web is a great resource for learning about how to create and maintain your business's Web site. Here are some of our favorites.

► DevHead

www.zdnet.com/devhead

ZDNet's DevHead offers tools, reviews, news, columns, and tutorials covering all your Web development needs. You can read an overview of such elements as DHTML and Cascading Style Sheets, check your site's code for flaws, and download free JavaScripts.

► Developer.com

www.developer.com

A warehouse of technical infor-

mation, Developer.com has tutorials and downloadable code for a variety of scripting languages, as well as guides and forums on developer tools and environments, markup languages, scripting, and more.

► HotWired: Webmonkey

www.webmonkey.com

Though this well-designed site (which actually incorporates the technologies it discusses) concentrates on the cutting edge, it offers information and articles on almost any topic Web developers might desire. Besides the knowledgeable articles and useful glossaries, its most notable assets are the "Crash Course" tutorials on various Web standards.

► Index Dot HTML

www.blooberry.com/html/intro.htm

HTML developers will find this a great reference for code, stylesheets, and more.

► LinkExchange SiteOwner

www.siteowner.com

An excellent resource for developers putting the finishing touches on a site, SiteOwner provides tools for analyzing your site's code and images, creating metatags, and even submitting your URL to popular search engines.

► MSDN Online Web Workshop

www.msdn.microsoft.com/workshop

Part of Microsoft's developer resources, the Online Web Workshop provides information on topics ranging from DHTML to security. You'll find extensive overviews as well as instructions and tips for incorporating various Web technologies.

► projectcoolmedia

www.projectcool.com

From advice and tutorials for the budding Webmaster to the latest programming developments for the seasoned pro, this site will keep all developers informed of the latest goings-on.

► Slashdot

www.slashdot.org

Known as "News for Nerds," Slashdot is a great informational resource for developers, offering news and particularly useful discussion threads.

► Web Building

home.netscape.com/computing/webbuilding

Rather than being tool- or lesson-oriented, Netscape's site focuses on news and articles about the latest Web technologies. This site is best suited to the developer who wants to keep abreast of the latest Web trends or seek advice on how to improve a site.

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DESIGN it

Having a Web site is a fundamental part of doing business these days, and no one wants to be caught without a .com on his or her business card. Therefore, creating a Web site should be as straightforward as any other form of business communications. But this hasn't been the case. WYSIWYG Web authoring tools have been suitable for building only simple sites, while more powerful tools have required knowledge of HTML and scripting languages. But those days are finally over.

As the Web evolves, demand for tools that are more sophisticated yet easy to use keeps growing. And the software industry is responding with WYSIWYG tools that let you create a cutting-edge site and keep it up to date without giving up your weekends. We tested seven WYSIWYG tools, including the latest versions of Microsoft FrontPage, NetObjects Fusion, and Macromedia's Dreamweaver, ranging in price from \$100 to \$300 (street).

Although the latest authoring tools are packed with powerful features, they are still relatively easy to use. You can actually have a simple site up and running in less than an hour. For example, Microsoft FrontPage 2000 has wizards for building common site types ("Corporate Presence," for example) and ready-made design themes to give your site a consistent, polished look.

But eventually you'll want to go beyond the "canned" site. These packages, especially Macromedia's Dreamweaver 2, all offer plenty of advanced authoring features for developing a more sophisticated online presence. Much of this functionality relies on expanded support for Dynamic HTML (DHTML). You can, for example, position objects—such as text or images—with pixel-level accuracy, using either Cascading Style Sheets (CSS) or tables. Because not all browsers

support CSS, a few programs even include scripts that check to see which browser a visitor to your site is using and then serve up the appropriate pages. DHTML components also make it easier to add special effects and animation.

Most of the programs we review also support popular animation formats (Macromedia's Flash and Shockwave) and streaming audio and video formats such as RealNetworks' RealVideo, Microsoft NetShow, and Apple QuickTime.

To turn browsers into buyers, you'll need to integrate your site with applications and databases. Although WYSIWYG authoring tools aren't designed to build such Web applications (for more information, see "Build It" in this issue), they can make the process a little easier. For example, NetObjects Fusion 4.0 includes a connector for linking pages to iCat Commerce Online, a popular e-commerce solution for small to medium-size businesses, and FrontPage can create pages that work directly with Microsoft SQL databases.

The best of the tools we review here devote nearly as much effort to site management as they do to authoring. For instance, FrontPage and Fusion keep track of where everything goes, so if you add or remove pages, the program automatically updates the navigation bars. Dreamweaver and Fusion use customizable page templates, so if you make a change to one of the templates, all of the pages in your site based on that template are automatically updated. Other useful site management features include sitewide search-and-replace, hyperlink verification, and the ability to upload only changes to your site.

A business Web site is not an electronic brochure; it's another way to ensure your company's success. Similarly, today's Web authoring tools are more than utilities for creating and publishing a Web site; they are productivity applications that you can use regularly to design, redesign, and maintain your site as your business grows.

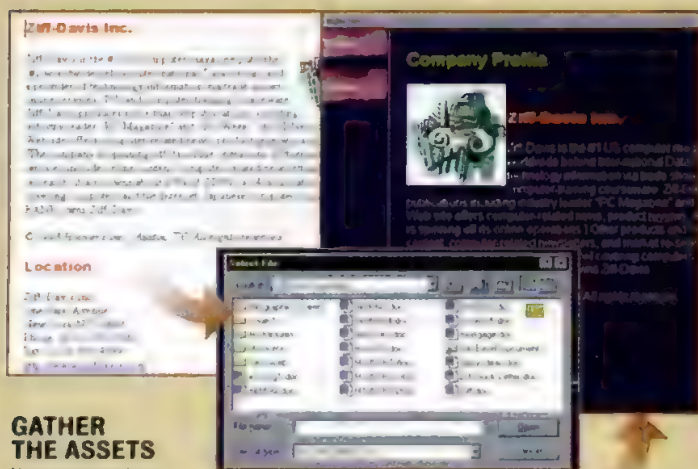
BY JAN OZER



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DESIGNING A WEB SITE



GATHER THE ASSETS

You can create a Web site from scratch, but it's a lot easier to use existing content. We especially liked Microsoft FrontPage 2000's ability to import Microsoft Word documents directly, rather than first converting them to HTML.

Adobe PageMill 3.0

\$80 street; upgrade, \$50. Adobe Systems Inc., San Jose, CA; 800-411-8657; www.adobe.com.

Version 3.0 of Adobe's first Web authoring tool, Adobe PageMill, remains a basic WYSIWYG page creation tool that has fallen behind the times. Adobe recently acquired GoLive, a more advanced authoring tool that was not ready in time for our testing (see the sidebar "Adobe Ups Its Authoring Ante") but should provide stiffer competition to advanced design tools such as Macromedia's Dreamweaver 2.

PageMill's shortcomings become apparent as soon as you begin a project. Because no wizards are provided, you must either import and modify existing pages or build new pages from scratch. The Inspector, a floating tool palette, provides access to tools for modifying objects such as frames, images, and forms. Unlike some programs that give you graphical tools for creating and positioning tables, PageMill forces you to use a dialog box to edit tables. And when you're creating frames, you can set some important elements, such as the "base target" (which specifies the frame in which all links from a frame will open), only by editing the HTML code by hand.

You can work on multiple files at once in separate windows, and each window can be toggled between editing and preview

mode by clicking a large icon. The preview mode uses either Internet Explorer or a built-in browser.

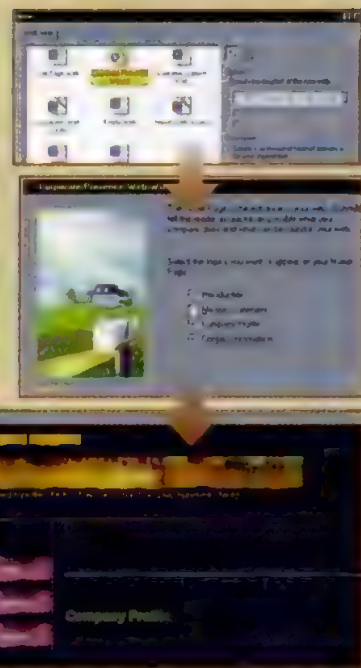
In addition to edit and preview modes, PageMill has an HTML source-code mode. On our tests, we had difficulty using this mode with pages containing frames. To create sufficient space to view and edit the code, you have to resize the frames, and it is difficult to restore them to their proper sizes when you're done.

When importing Web pages, PageMill reformats code so that forms and similar elements become almost unreadable. A useful feature inserts a comment in the source code to indicate the cursor position, so you can return to the same place in your file.

The program conveniently keeps track of links on a site, so if you move a page from one folder to another, PageMill automatically updates all links. Another convenient feature automatically converts BMP images to GIF format when

CREATE QUICK PAGES

Let the authoring tool do the work for you. FrontPage's wizard lets you select the type of site, the pages to include, and the information they should contain. The last step in the wizard is to choose a design for the site, and FrontPage takes care of the rest.

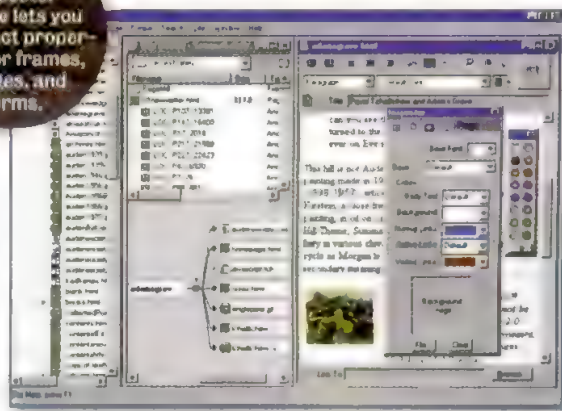


you insert them in a page.

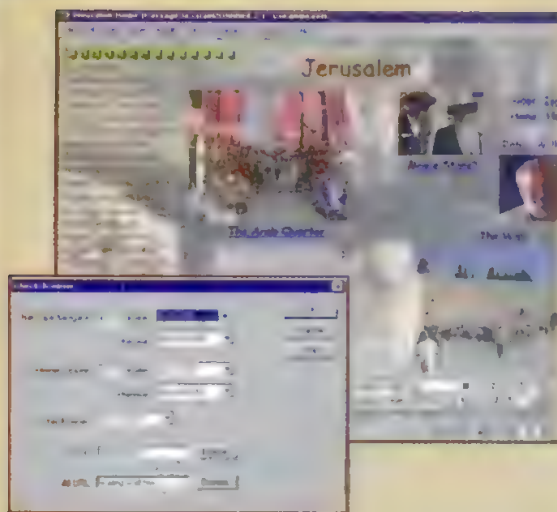
PageMill doesn't support up-to-date features such as Cascading Style Sheets or DHTML, and if you want to import Microsoft Word files, you'll first have to save them in Word 6.0 format. But PageMill can import Corel WordPerfect, RTF, and other standard formats.

PageMill's file handling can cause confusion and errors if you don't pay close attention. For example, when you drag a GIF or JPEG file from Windows Explorer onto a page, PageMill creates a link to the file on your disk but doesn't upload the file to a remote server. The page on the server

PageMill's Inspector palette lets you set object properties, for frames, images, and forms.



Our Contributors: JAN OZER and EDWARD MENDELSON are contributing editors of *PC Magazine*. DIANE JECKER was the project leader, and JOHN MORRIS was the associate editor in charge of this story.



GET MORE SOPHISTICATED For a more professional look, you'll need greater control over the elements on the page and how they are displayed in different browsers. Macromedia Dreamweaver 2's Layers feature lets you place objects on the page with pixel-level accuracy. It also lets you create pages that target different browsers.

contains a link to the image file on your local disk, so it displays correctly when you view it but not when anyone else does. But PageMill does correctly relocate and upload GIF and JPEG images when they're dragged from a browser. Once your files are where they belong, the built-in FTP client works smoothly.

The program's site frame confusingly lists all files in the site's folder, regardless of whether they are actually in use. A more helpful feature lists external and broken links. One especially clever feature is a graphical search-and-replace dialog box.

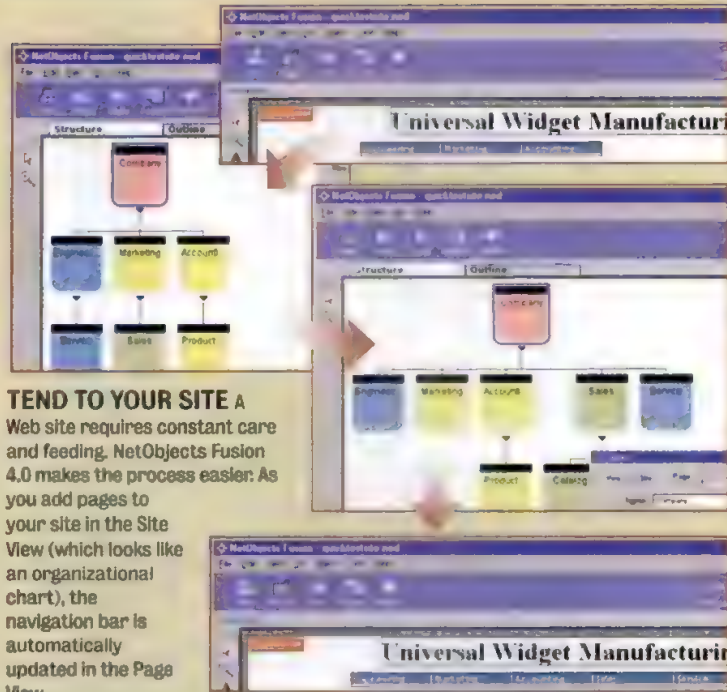
Despite a few bright spots, Adobe PageMill 3.0 is missing several important features and suffers from too many program quirks. Our advice: wait for Adobe GoLive to arrive or consider another product such as Macromedia's Dreamweaver 2, Microsoft FrontPage 2000, or NetObjects Fusion 4.0—*Edward Mendelson*

Dreamweaver 2

\$300 street. Macromedia Inc., San Francisco; 800-457-1774, 415-252-2000; www.dreamweaver.com.



Macromedia's Dreamweaver 2 doesn't do everything, but what it does—advanced authoring—it does extremely well. Dreamweaver eschews canned templates and automated tools in favor of a



TEND TO YOUR SITE A Web site requires constant care and feeding. NetObjects Fusion 4.0 makes the process easier: As you add pages to your site in the Site View (which looks like an organizational chart), the navigation bar is automatically updated in the Page View.

design environment that provides complete control over the way pages look and act within a Web browser. Less experienced Webmasters will be better off with a more well-rounded program,

such as Microsoft FrontPage 2000, but for creating sites on the bleeding edge of design, there's no better choice than Dreamweaver.

Dreamweaver's design interface is

EDITORS' CHOICE

 **Authoring and site management: MS FrontPage 2000**

 **Advanced site design: Dreamweaver 2**



When choosing a tool to design and tend to your company's Web site, consider the kind of site you want to build and how much time you're willing to invest in

the project. Both of our Editors' Choice selections, Microsoft FrontPage 2000 and Macromedia's Dreamweaver 2, are powerful WYSIWYG editors with many of the same general authoring features, but they are designed for different users.

FrontPage is the easiest to use of the authoring tools we tested, automating many of the tasks associated with creating and maintaining your site. Tell FrontPage what kind of site you want and how you want it to look and the program builds the site for you. Front-

Page even automatically creates and updates navigation bars. Furthermore, no other product in this category offers better site management features.

Macromedia's Dreamweaver 2 lacks some of the automation and site management features, but makes up for this with the most comprehensive suite of high-end design tools in this roundup.

If you'd like to have your site open for business as quickly and easily as possible, FrontPage is a great choice. If you'd rather start with a blank page and a vision of your site, you'll prefer Macromedia's Dreamweaver 2.



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The **installation and setup** rating reflects how easily and quickly the program can be installed.

For **simple site creation**, we look at features for creating a

basic site, such as **page templates**, **wizards**, and **design themes**. We also look for support for importing legacy files, image handling, and the ability to create and edit HTML tables and forms pages easily.

For the more advanced user, we evaluate the selection of **advanced site creation** tools provided for targeting specific browsers; whether the program provides support for the precise positioning of

objects; whether it supports DHTML, CSS, ASP, multimedia, Java, VB, layers, image maps, and ODBC; and whether you can easily implement global page changes or hierarchical page structure changes, or add pages.

For **site management**, we look at how the application assists the user after the site is published. Key features include hyperlink verification, navigation bars that auto-update when you change site structure, and easy incremental uploads.

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Dreamweaver offers an extraordinary range of DHTML effects with a timeline for precise control over the movement of objects. You can set target browser levels so Dreamweaver displays only compatible effects. Or, you can create alternative pages for different browsers and have your site query the remote browser, sending only the appropriate pages. In addition to complete support for Macromedia's Flash and Shockwave, Dreamweaver also integrates with multimedia formats such as RealVideo and IBM's HotMedia.

Before uploading your site, Dreamweaver can check your page for compatibility with Versions 2 through 4 of both Internet Explorer and Netscape Navigator, verifying all internal (but not external) links. Dreamweaver collects all site elements into one directory and provides a very capable FTP client for publishing the complete site and incremental changes.

If you can dream it up, Dreamweaver can turn it into reality on your Web pages.—Jan Ozer

Home Page 3.0

\$99 list. FileMaker Inc., Santa Clara, CA; 800-325-2747; www.filemaker.com.

● FileMaker (formerly Claris Corp.) has positioned Home Page 3.0 as a means to create an Internet front end to FileMaker Pro databases. Although Home Page performs this role quite well, its limited feature set and sluggish performance will deter Web developers from using it as a general authoring tool.

Two main views in Dreamweaver are the Site view (background) and Page view (foreground).



A MORE DYNAMIC WEB

Sites have grown a lot more sophisticated since Dr. Tim Berners-Lee invented the Web a little more than a decade ago, but there are some things HTML was simply never meant to do. Though Web sites are great at displaying static text and images, without special browser plug-ins they struggle with the dynamic, interactive content typically found in computer games or multimedia CD-ROMs. That's where *Dynamic HTML*, or DHTML, comes in. Although DHTML got off to a slow start, it is finally poised to live up to its full potential.

For developers, DHTML means precise control over the placement of objects on the page, object animation, and interactive component embedding in Web pages—without depending on plug-ins or writing complex Java applets or ActiveX controls. For users, it means Web sites that are more engaging and interactive, without having to reload pages all the time.

Unlike HTML, DHTML is not a single standard. Rather, it is a collection of technologies that together enable more dynamic Web content. The three main components are HTML, Cascading Style Sheets (CSS), and a scripting language such as JavaScript (now standardized by the World Wide Web Consortium as EcmaScript) or VBScript. These three components are tied together by DOM, the Document Object Model.

From a design standpoint, one of the chief weaknesses of HTML is that it is not a page-layout language, so it is difficult to position objects precisely on the page. Products such as NetObjects Fusion 4.0 get around this problem by using invisible, nested tables (tables within tables) to divvy up the page into regions where objects are placed. Although this approach works—and is still used when targeting Version 3.x or earlier browsers that do not support DHTML—it is an inefficient workaround.

A better solution is Web style sheets, which describe how pages should be displayed on-screen or when printed. The World Wide Web Consortium (W3C) has come up with two recommendations for Web style sheets, CSS1 and CSS2, that are widely—though not consistently—supported in Versions 4.x and later of Microsoft Internet Explorer and Netscape Navigator (www.w3c.org).

The advantage of CSS is that it lets you specify the *x,y*-coordinates for positioning objects on a page—down to the pixel level. In addition, CSS lets you layer text, images, and other objects on top of one another—even off to the side of the page—by specifying a third coordinate (the *z*-index).

Because DHTML uses the Document Object Model, every element on the page is treated as a separate object. These objects can be manipulated using a scripting language. For example, using only CSS, DOM, and a relatively simple script, you can position a text block at the edge of the screen and have it swoop in or do a lap around the page. Many other eye-catching effects, such as image rollovers, page transitions, and slide shows, are also possible.

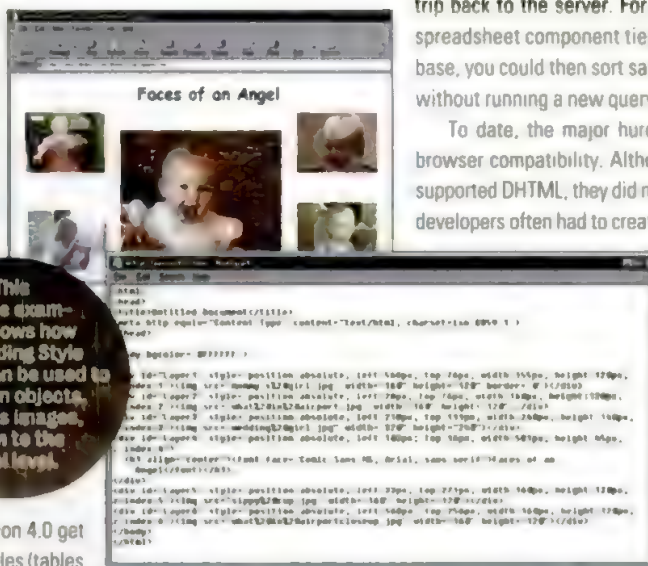
Another big advantage of DHTML is that it transfers some of the processing from the Web server to the client PC. Usually, when you click on an item on a Web page, the browser must load a new frame or page. When you download a DHTML page, however, any scripts on it are also completely downloaded, so you can interact with the information on the page without another trip back to the server. For example, if you downloaded a spreadsheet component tied to your company's sales database, you could then sort sales by region within the browser without running a new query via the Web server.

To date, the major hurdle for DHTML has been cross-browser compatibility. Although both IE4 and Navigator 4.0 supported DHTML, they did not implement it the same way, so developers often had to create two sets of pages if they wanted to use DHTML. Netscape has announced that the next version of Navigator will fully support DHTML, however, bringing it more in line with IE4 and IE5.

Many of the WYSIWYG authoring tools we review in our main story now support DHTML as well. Products such as Macromedia's

Dreamweaver 2 let you place objects on the page with pixel-level accuracy; you can then decide whether to publish the pages using CSS or the nested tables supported by version 3 and earlier browsers. You can even publish both sets and Dreamweaver lets you serve the appropriate set of pages depending on which level browser the visitor to your site is using. These developments should pave the way for more widespread acceptance of DHTML and give rise to more exciting Web pages.

To see some examples of how DHTML can enhance the design of a Web page or make it more functional, take a look at some of the many DHTML sites on the Web. Some good places to start include ZDNet's own Devhead section (www.devhead.com/filters/dhtml), The Dynamic HTML Zone (www.dhtmlzone.com), and the W3C's section on Web style sheets. —Jan Ozer



Home Page provides several site templates, including a business presence template. But the program gives you little ability to edit the style to make it your own. The program stores sites in a WST file, which simplifies content assembly and uploading. But the program offers no structural view of your site as a whole. Strangely, you can't delete pages from within the program;

you have to use Windows Explorer.

The interface in which you design pages is well organized, using menus rather than floating palettes. Each page element has an Object Editor that contains descriptive parameters for such attributes as height, width, and borders. There are three page views: WYSIWYG edit, Preview, and HTML edit, plus a browser control that can preview in any or

all installed browsers at one time.

Home Page's design tools are competent but unremarkable. The table editor has been improved, but it still doesn't support drag-and-drop operation. And the Frame Assistant, though logically implemented, seems needlessly detailed. Home Page performed well on our HTML import tests, but the program failed to grab images when we cut and pasted pages

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COVER STORY

Web Site Authoring



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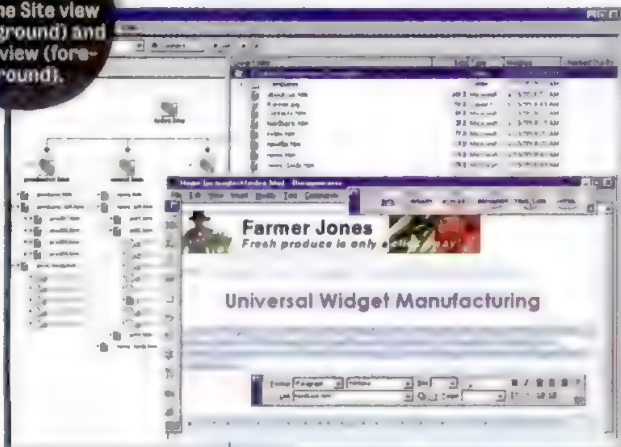
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The advantage of CSS is that it lets you specify the x,y-coordinates for positioning objects on a page—down to the pixel level. In addition, CSS lets you layer text, images, and other objects on top of one another—even off to the side of the page—by specifying a third coordinate (the z-index).

Because DHTML uses the Document Object Model, every element on the page is treated as a separate object. These objects can be manipulated using a scripting language. For example, using only CSS, DOM, and a relatively simple script, you can position a text block at the edge of the screen and have it swoop in or do a lap around the page. Many other eye-catching effects, such as image rollovers, page transitions, and slide shows, are also possible.

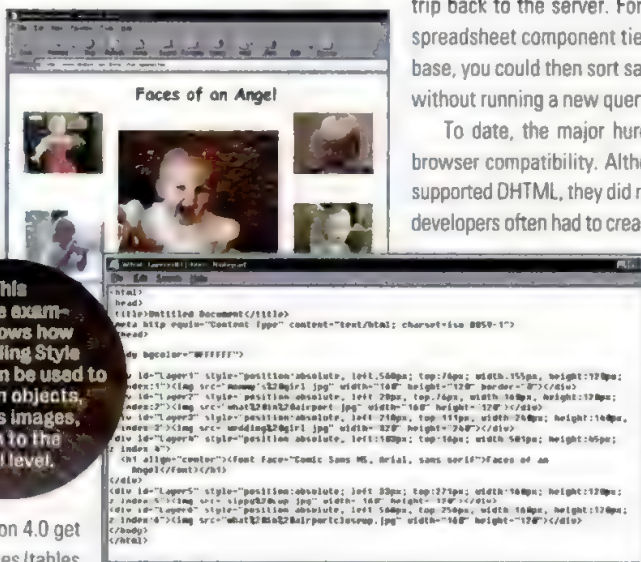
Another big advantage of DHTML is that it transfers some of the processing from the Web server to the client PC. Usually, when you click on an item on a Web page, the browser must load a new frame or page. When you download a DHTML page, however, any scripts on it are also completely downloaded, so you can interact with the information on the page without another trip back to the server. For example, if you downloaded a spreadsheet component tied to your company's sales database, you could then sort sales by region within the browser without running a new query via the Web server.

To date, the major hurdle for DHTML has been cross-browser compatibility. Although both IE4 and Navigator 4.0 supported DHTML, they did not implement it the same way, so developers often had to create two sets of pages if they wanted to use DHTML. Netscape has announced that the next version of Navigator will fully support DHTML, however, bringing it more in line with IE4 and IE5.

Many of the WYSIWYG authoring tools we review in our main story now support DHTML as well. Products such as Macromedia's

Dreamweaver 2 let you place objects on the page with pixel-level accuracy; you can then decide whether to publish the pages using CSS or the nested tables supported by version 3 and earlier browsers. You can even publish both sets and Dreamweaver lets you serve the appropriate set of pages depending on which level browser the visitor to your site is using. These developments should pave the way for more widespread acceptance of DHTML and give rise to more exciting Web pages.

To see some examples of how DHTML can enhance the design of a Web page or make it more functional, take a look at some of the many DHTML sites on the Web. Some good places to start include ZDNet's own Devhead section (www.devhead.com/filters/dhtml), The Dynamic HTML Zone (www.dhtmlzone.com), and the W3C's section on Web style sheets. —Jan Ozer



Home Page provides several site templates, including a business presence template. But the program gives you little ability to edit the style to make it your own. The program stores sites in a WST file, which simplifies content assembly and uploading. But the program offers no structural view of your site as a whole. Strangely, you can't delete pages from within the program;

you have to use Windows Explorer.

The interface in which you design pages is well organized, using menus rather than floating palettes. Each page element has an Object Editor that contains descriptive parameters for such attributes as height, width, and borders. There are three page views: WYSIWYG edit, Preview, and HTML edit, plus a browser control that can preview in any or

all installed browsers at one time.

Home Page's design tools are competent but unremarkable. The table editor has been improved, but it still doesn't support drag-and-drop operation. And the Frame Assistant, though logically implemented, seems needlessly detailed. Home Page performed well on our HTML import tests, but the program failed to grab images when we cut and pasted pages

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(all models):

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- MaxScreen: 14.1" XGA TFT

Plus:

- All-in-one design
- i.LINK™ (IEEE-1394) port for DV still image capture

Pre-installed Software (all models)

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- Microsoft® Outlook™ 98
- Microsoft Works
- Adobe PhotoDeluxe®
- Sony Picture Gear™
- Sony DVgate™ Still

¹ Using optional second battery in floppy drive bay. Battery life based on usage.
¹¹ With weight saver in floppy drive bay.

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- High-capacity Lithium-Ion battery, dual battery capability
- 128-bit graphics acceleration
- Built-in stereo speakers
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- 128-bit graphics acceleration
- Built-in stereo speakers
- Digital touch pad

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- 128-bit graphics acceleration
- Built-in stereo speakers
- Digital touch pad

Customize with:

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The new Sony notebook with a built-in digital camera.

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PCG-C1 \$2,299.99

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- Built-in CCD camera (Motion Eye)
- 8.9" XWIDE TFT LCD Display (1024 x 480)

- Windows 98
- Adobe PhotoDeluxe
- Pre-installed original Sony multimedia software with Smart Write, Smart Publisher and Smart Capture
- 17mm pitch/2mm stroke keyboard

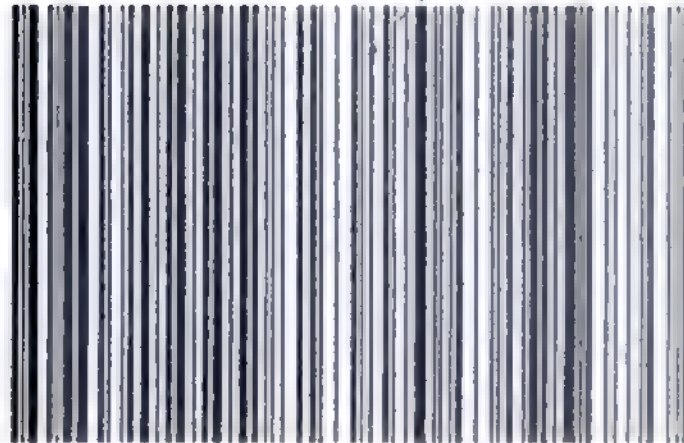
- 2.5 lbs., 1.5" thin
- i.LINK (IEEE-1394) port for DV still image capture
- Magnesium-alloy display housing
- Integrated Universal Serial Bus (USB)
- Integrated V.90 modem
- External USB floppy drive



1. Follow instructions on the other side

Back

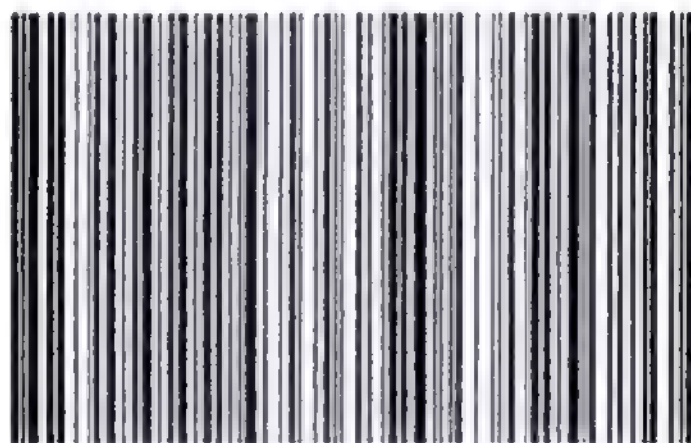
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Inverted Back

1. Follow instructions on the other side

Folded edge of the page

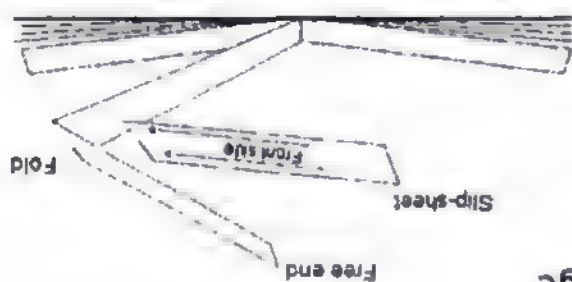


GbsSlipSheet-001

Inverted Foldout slip-sheet

Foldout slip-sheet

1. Open the foldout page
2. Insert this sheet with
 1. Front side touching the free page
 2. Arrow pointing to the fold
3. Slice the folded edge
4. Close the page and slip-sheet



1. Open the foldout page
2. Insert this sheet with
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 2. Arrow pointing to the fold
3. Slice the folded edge
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SONY

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ICD-3000
\$149.95



SONY

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PLM-2700
\$2,599

as low as
\$46.92 a month*
*See add-on items on back page



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A bigscreen display that's portable? The PC Glasstron™ monitor creates a virtual 30" high-resolution image—for your eyes only. It's head-mounted to offer you the most in mobility and privacy. And its built-in headphones make your multimedia experience even more amazing. Just plug it into your notebook and other video sources and let the games begin.

MEMORY STICK IC RECORDING MEDIA



Introducing the next generation of digital data storage—Memory Stick™ Media. Smaller than a stick of gum, but with five times the storage capacity (MSA-8A model) of a standard 3.5" floppy disk, Memory Stick Media is expected to become the new industry standard for storage and transfer media. Plus, it makes it even easier for you to transfer images, sounds, data and text between cameras, computers and more.

4 MB Memory Stick Media	Model: MSA-4A	Price: \$29.99
8 MB Memory Stick Media	Model: MSA-8A	Price: \$39.99
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accessorize as only you and sony can

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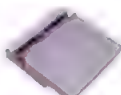
THE CREATION OF A NOTEBOOK ACCESSORY



- **Carrying Case**
PCGA-CC7 **\$99.99.** Air-cushioned, this case holds your notebook, AC adapter, extra battery and floppy or CD-ROM drive.



- **AC Adapter**
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- **Rechargeable Battery Pack**
PCGA-BP71 **\$249.99.** Up to 8 hours with two batteries. Note: Battery life may vary based on usage.

- **Extra 4 GB Hard Drive**
PCGA-HD740 **\$499.99.** Adding a second 4 GB hard drive in the versatile drive bay increases your storage capacity for large applications.

THE NEW ALL-IN-ONE NOTEBOOK ACCESSORIES



- **AC Adapter**
PCGA-AC71 **\$99.99.** Get an additional AC adapter and keep one at home and one at work.



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- **Network Port Replicator**
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THE NEW ALL-IN-ONE NOTEBOOK ACCESSORIES



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- **AC Adapter**
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PCGA-CC1A **\$149.99.** Includes a convenient Velcro™ detachable fitted leather glove-casing.

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- **Battery Charger**
PCGA-BC1 **\$199.99.** Quickly charge two batteries simultaneously. Compatible with Standard and Long-Life batteries.

- **Standard Rechargeable Battery Pack**
PCGA-BP11 **\$149.99.** Lithium-Ion battery provides up to 3 hours capacity. Note: Battery life may vary based on usage.

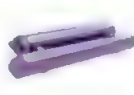
THE NEW ALL-IN-ONE NOTEBOOK ACCESSORIES



- **External 14X CD-ROM Drive**
PCGA-CD5: **\$299.99.** AC adapter and PC Card interface supplied. Requires AC power for operation.



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- **Rechargeable Battery Pack**
Long-Life: PCGA-BP52: **\$299.99.** Up to 7 hours with 505TS; up to 6 hours with 505TX. Note: Battery life may vary based on usage.
Standard: PCGA-BP51: **\$149.99.** Up to 3 hours with 505TS; up to 2.5 hours with 505TX. Note: Battery life may vary based on usage.



- **Port Replicator**
PCGA-PR5 **\$99.99.** Ports: Parallel printer, PS/2 keyboard and PS/2 mouse and VGA monitor.



- **Stereo Speakers**
PCGA-SP51 **\$99.99.** External clip-on speakers that give you even more sound.



- **AC Adapter**
PCGA-AC51: **\$99.99.** Get an additional AC adapter and keep one at home and one at work.

- **Battery Charger**
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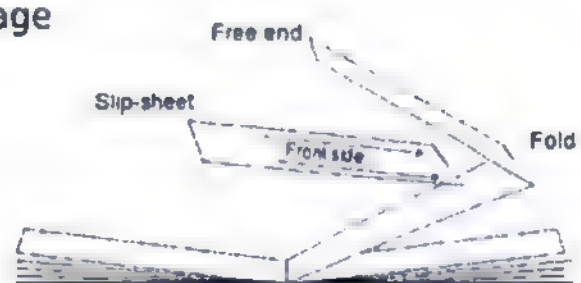
Inverted Foldout slip-sheet



Folded edge of the page

Foldout slip-sheet

1. Open the foldout page
2. Insert this sheet with
 1. Front side touching the free page
 2. Arrow pointing to the fold
3. Slice the folded edge
4. Close the page and slip-sheet



1. Open the foldout page

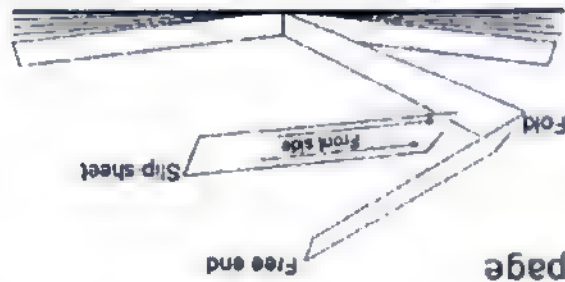
2. Insert this sheet with

1. Front side touching the free page

2. Arrow pointing to the fold

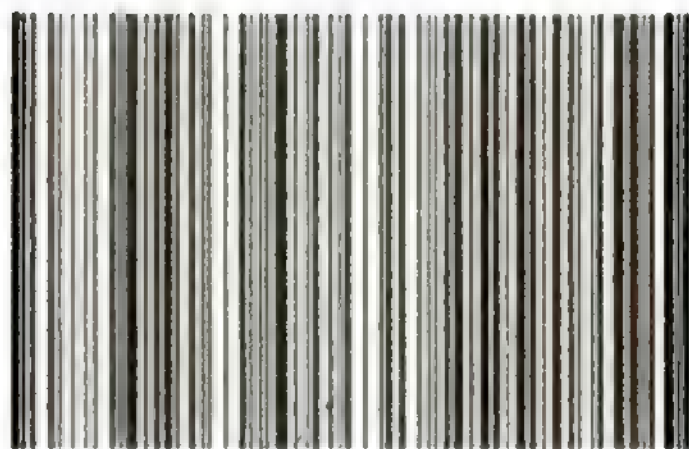
3. Slice the folded edge

4. Close the page and slip-sheet



1. Follow instructions on the other side

Inverted Back



Gbs5lipBack-001B

Back

1. Follow instructions on the other side

THE 838 MODULAR NOTEBOOK

Swap any drives and battery to take only what you need.

The new Sony VAIO 838 Notebook is just what every power-hungry office nomad is looking for. More power and portability. Packed with our road-warrior 3MAX™ features, this notebook offers **MaxMobility** (under 6 lbs. and less than 1.75" thin), **MaxScreen** (a full-color 13.3" high-resolution XGA display) and **MaxBattery** (up to 8 hours of power without a charge). Plus, the DVD-ROM drive, floppy disk drive, second battery¹ or second hard drive² are all interchangeable so you take only what you need. All told, it's a mighty powerful PC wrapped in a light and slim package.

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(offer expires 5/31/99).

FREE USB Mouse with upgrade, a \$49.99 value

3MAX Features:

- MaxMobility: Less than 7 lbs.³; 1.75" thin
- MaxScreen: 13.3" Active Matrix LCD Display
- MaxBattery: 2X battery life^{4,5}
- Using optional second battery in floppy drive bay

Pre-installed Software:

- Windows 98
- Microsoft Outlook 98
- Microsoft Works
- Adobe PhotoDeluxe

¹Using optional second battery in floppy drive bay. Battery life based on usage.
²With weight cover in floppy drive bay.
³With optional second hard drive and removable drive bay. Battery life may vary based on usage.

3MAX.

838 \$2,699.99

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- Intel Pentium II processor 366 MHz
- 64 MB SDRAM
- 6.4 GB removable hard drive
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- Removable drive bay for DVD-ROM drive, floppy disk drive, second battery, second hard drive
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- Sony DVgate Still

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- One type II PC Card slot with card bus zoomed video support

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Customize with:

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505TS \$1,799.99

As low as \$32.48 a month*

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- 10.4" SVGA Active Matrix Display
- V.90 modem
- High-capacity Lithium-Ion battery
- Touch pad with pen operation
- Bundled port replicator and external floppy disk drive
- One type II PC Card slot with card bus zoomed video support

\$100 Rebate with purchase of VAIO 505TS and CD-ROM Drive (PCGA-CD5). (Offer expires 5/31/99).

\$100 Rebate with purchase of VAIO 505TS SuperSlim notebook. (Offer expires 6/30/99)

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SN-699-tpg

WEB DATABASES, WITHOUT CODING



Almost all large-scale business Web sites rely on databases to keep tabs on products, customers, and online transactions. But surprisingly, few Web design tools make it easy to build such database-driven Web applications.

Some of the products reviewed in our main story integrate with databases. But with the exception of FileMaker's Home Page 3.0, which is designed to work in tandem with FileMaker Pro databases, WYSIWYG authoring tools rely on awkward add-ons that provide only limited database support. At the opposite extreme are tools such as Allaire's ColdFusion 4.0, our Editors' Choice for building Web applications ("Build It"), which provide lots of power but are strictly for developers and cost thousands of dollars. Between these two extremes lies Elemental Software's **Drumbeat 2000** (\$400 street), which was designed to offer a graphical interface for building HTML-based front ends to ODBC databases.

To begin building your application, you answer a series of questions in Drumbeat's DataForm Wizard, which now supports more than 30 elements for displaying and importing data from Web pages such as checkboxes, drop-down lists, edit boxes, and sliders. When you've completed the wizard, Drumbeat automatically generates the Active Server Pages (ASPs) that let Web visitors access and update data from a Web browser. To extend the functionality of the application, the program includes a library of prebuilt components called DrumNotes for tasks such as using cookies, creating multipage forms, and validating data entry. And Drumbeat includes six sample Web applications, including an employee directory.

Like NetObjects Fusion 4.0, Drumbeat 2000 uses a proprietary file format during the design phase and converts pages to HTML when you publish the site. A One-Button Publishing wizard simplifies the process of saving and updating your site. Because Drumbeat's database features rely on ASP, they work only on Microsoft Windows NT servers running Microsoft Web servers (IIS or Personal Web Server). But third-party products such as Chili!Soft's Chili!ASP (starting at \$995 list) expand support for ASP to other platforms such as Unix servers running Apache, Netscape, and O'Reilly Web servers.

Drumbeat's primary market is department-level intranets. But Elemental Software is pushing the product in the next logical direction: e-commerce. The new Commerce Solution is a Drumbeat add-on that provides a shopping cart for taking orders, transaction processing, and a store manager. This version, which is expected to cost about \$400 (final pricing hasn't been set), supports two payment-processing systems, ICVerify and CyberCash, but others can be added as needed. In addition, Elemental Software has issued a minor update to Drumbeat 2000 that improves performance under Windows 95 and 98 and creates better framesets and tables, among other enhancements.

Despite its point-and-click interface, Drumbeat is still not for beginners. It helps to have some knowledge of database queries and HTML forms. But for Web developers who want to make the leap from static HTML pages to dynamic, data-driven Web sites, Drumbeat 2000 hits all the right notes. (Elemental Software, Carlsbad, CA; 877-378-6232; www.drumbeat.com.)—EM

from the Web. Home Page can't import pages directly from Microsoft Word.

Like Macromedia's Dreamweaver 2, Home Page lets you design pages to target specific display resolutions, including 640-by-480 and 800-by-600. It also displays estimated download times for pages at various connection speeds. The program itself was noticeably slower than other editors, however.

Not surprisingly, Home Page's most noteworthy feature is its Connection Assistant for FileMaker Pro 4.0 databases. After you identify the target database, the Assistant lets you choose fields to interface with, as well as desired actions such as "Add new records to a database," and it creates all required pages, forms, and database links. The Connection Assistant is easier to use than FrontPage's new database wizards, but it works only with FileMaker database, not with Microsoft Access, SQL, or other databases.

But Home Page offers little in the way of other advanced functionality. For instance, it offers no support for DHTML, Cascading Style Sheets, or pixel-accurate positioning. Although it does support QuickTime, Home Page offers no easy way to integrate other multimedia formats.

In this version, FileMaker has slightly enhanced the site-management features by adding a highly useful hyperlink checker and global search and replace. But Home Page lacks many of the more sophisticated automation tools found in other packages. It doesn't generate or update navigational bars. Nor does it automatically update your pages when you edit the templates upon which they are based; you must manually add changes to each page. Without these features, it can be quite a chore to keep all but the simplest of sites up to date.

Home Page is basically a one-trick pony: If you use FileMaker Pro to create databases, Home Page is the natural way to extend these to the Web. But for all other Web authoring tasks, you'll find many better choices reviewed here.—JO

HoTMetaL PRO 5.0

\$129 list. SoftQuad Software Inc., Toronto; 800-387-2777, 416-544-8879; www.softquad.com.

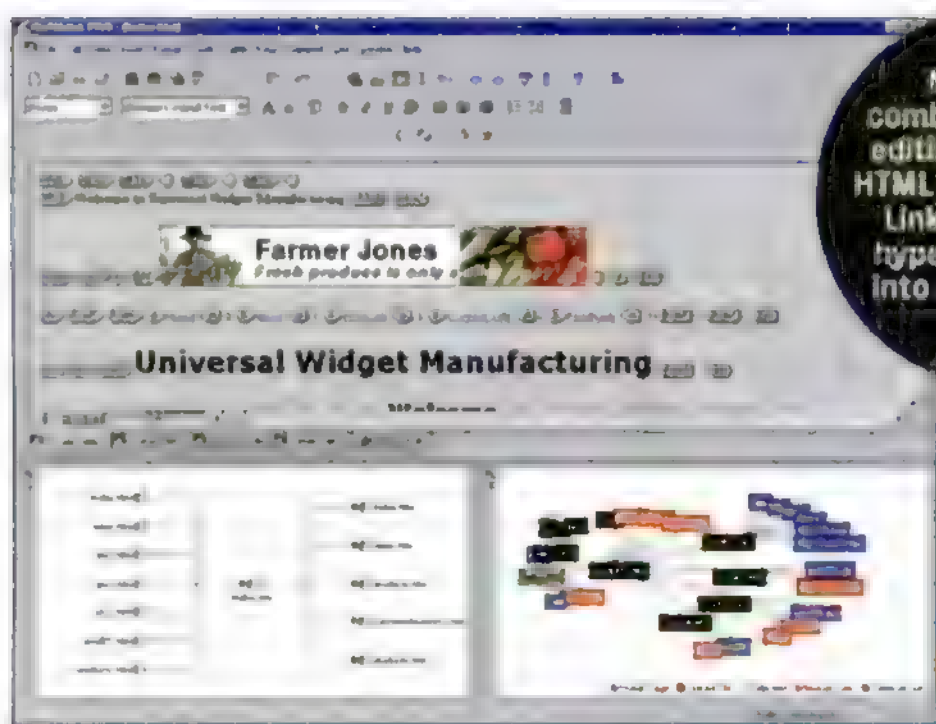
● A product in transition, HoTMetaL PRO is moving away from its developer-oriented roots as an HTML editor and toward a full WYSIWYG approach targeting consumers. As a result, HoTMetaL PRO 5.0 isn't ready to compete with the

top products in this category in ease of use or features—especially site management features. Though this version is a must-have upgrade for loyal HoTMetaL developers, budding Webmasters should steer clear for now.

HoTMetaL gets off to a solid start. You begin building with HoTMetaL's Site Maker template. Here you enter your basic biographical or company information and then select from a very extensive list of useful page templates. This let us generate all the pages necessary for our tests easily. You then select from five page layouts and 18 decors (though we found that several color schemes rendered text unreadable against the background).

When you add new pages to this basic site, they don't automatically take on the template's characteristics, so you have to update them manually to maintain a consistent look. When you link pages in the program's Web view, HoTMetaL automatically adds the links but doesn't update the navigation bar.

After you select and format pages, your site loads as a project within HoTMetaL's main interface, a confusing potpourri of dockable pages, fixed toolbars, and floating palettes. The main editing



window can display your page as HTML code, in WYSIWYG view, or with "Tags On," an unusual combination of WYSIWYG pages with in-line HTML tags.

HoTMetal can import HTML pages, and it did so successfully with all the pages in our test's site except one, which produced an HTML error that the program could not resolve. You can't import documents from Microsoft Word, and when we cut and paste items from Word or Microsoft Internet Explorer, all of the formatting was lost.

Project assets are contained in the Resource Manager, and a Page Links window shows links flowing in and out of the selected page. An innovative Web View depicts a near 3-D perspective of your site, which is useful when working with especially complex sites.

Image handling, text creation, and linking all worked well. We especially like the ability to load multiple pages into the edit window and switch between them using tabs. Table editing was another strength. Creating frames, on the other hand, is confusing, tedious, and poorly documented. And HoTMetal lacks pixel-accurate positioning of objects.

HoTMetal implements most DHTML and Java effects—such as image rollovers, hit counters, and dynamic menus—as homegrown or third-party external objects. This open model is great for developers seeking to create their own canned effects, but objects lack the interface consistency and ease of use of those in programs such as Macromedia's Dreamweaver 2.

SoftQuad also offers its own components, including banner ad rotation, database connectivity, and statistical analysis tools, but these features rely on

FileMaker's Home Page 3.0, the program retains absolute links to images on disk, so if you upload and test from the same computer, images will appear without actually being present on the Web server.

HoTMetal has a few interesting features, but on the whole it is a product without a home. FrontPage offers more in an easier to use package, and Dreamweaver offers better high-end design features.—JO

Microsoft FrontPage 2000

\$150 street. Microsoft Corp., Redmond, WA; 800-426-9400; www.microsoft.com.



It's said that you can't be all things to all people, but Microsoft FrontPage 2000 comes darned close. With both basic and advanced authoring tools, extensive site management features, and the polished and easy-to-use interface you'd expect from a member of the Microsoft Office 2000 family (Premium Edition, \$400 Upgrade), FrontPage has something for everyone, from the weekend Webmaster to experienced developers.

Whether you're putting your company online or just designing a personal page, FrontPage includes a variety of useful templates for you. You use wizards to define the type of site, the pages you want to include, and the content that should appear on them. Then you select a design theme. The program creates all requested pages, providing navigation bars with interpage links.

We especially liked the fact that when you add or remove pages or even reshuffle the order in which they appear, FrontPage automatically updates the navigation bars. You can specify shared borders

HoTMetal's Application Server, which is not nearly as widely implemented as the FrontPage Server Extensions.

HoTMetal's asset tracking and publishing is also lacking. The program neither collects nor uploads assets, such as graphics files, automatically. Worse yet, like

or configurable areas where data such as navigation bars, logos, and copyright notices will appear on each page. Like NetObjects Fusion 4.0, FrontPage uses an organizational chart-like view to represent your site graphically.

Not surprisingly, FrontPage is especially adept at working with Microsoft Word and Internet Explorer 5.0. You can import Word files or cut and paste existing content from documents and Web pages with little loss of formatting.

The Page Design view looks like Microsoft Word, with extra icons for inserting images and other Web components. As with previous versions, in Microsoft FrontPage 2000 you perform most basic editing via embedded toolbars, menus, and extensive right-mouse-click controls. This leaves a well-organized and clutter-free workspace. Tabs at the bottom let you quickly access the page preview or edit the actual HTML code. This version has made retrieving and editing pages more efficient by combining the formerly separate Navigation and Editor views.

FrontPage has a powerful table editor that lets you drag and drop columns and rows on the page. It doesn't, however, support automatic sorting capabilities—a feature found in Macromedia's Dreamweaver 2. The frame creation tools are fairly intuitive, but a word of warning here: Frames can conflict with the navigation bars that are automatically generated by the program. We had to call technical support at Microsoft to fix this problem.

When it comes to highly advanced design features, FrontPage falls a little short of the mark set by Dreamweaver. For instance, while FrontPage now lets you precisely position text and graphics using CSS, it can't convert the layers to tables for compatibility with Version 3 browsers. And while FrontPage proved competent with NetShow, QuickTime, and RealAudio files, it can't handle RealVideo.

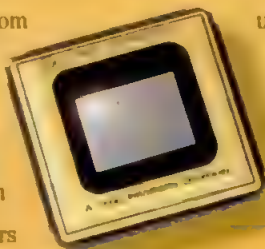
For each page, you can specify browser and browser level compatibility, and FrontPage will limit its extensive DHTML feature set accordingly. FrontPage can't, however, create a page that checks the remote browser and sends an appropriately configured page, another feature Dreamweaver supports. That said, FrontPage does provide some fairly

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CREATING DRAMATIC VISUAL EXPERIENCES THROUGH DIGITAL BRILLIANCE

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INSTRUMENTS**

ADOBE UPS ITS AUTHORING ANTE

Although Adobe Systems offers a handful of consumer and SOHO products, the company is best known for its professional-level graphics products. Adobe PageMill 3.0 is a consumer-level Web authoring tool that lacks the goods to compete with high-end packages such as Macromedia's Dreamweaver 2. But Adobe's recently acquired GoLive should beef up the company's presence in this area.

Adobe GoLive 4.0 has already been released for the Mac OS, and the Windows version (\$300 street) should be available around the time you read this. We tested an early (alpha) version that ran only on Windows NT.

GoLive will appeal both to designers who want to work in a rich graphical environment and code warriors who are comfortable working in a text editor. The main interface consists of a WYSIWYG editor that includes an optional grid for pixel-level positioning of objects; a context-sensitive formatting toolbar; a tabbed Inspector that lets you edit and preview HTML tags, graphics, or entire pages; and an object palette from which you can drag HTML tags, scripts, frames, and other elements directly to the page. The HTML Source Editor includes syntax checking and macros that insert scripts or other code, and it lets

you drag and drop objects into the source code.

Following Dreamweaver's cue, GoLive has forgone automated features—such as automatically creating navigation bars—in favor of advanced features such as DHTML authoring tools and a built-in script editor that supports line numbering and syntax checking. You can even save scripts in a library for use in other pages. A unique option adjusts font sizes to simulate the way pages will look on the Mac OS.

The graphical Site Manager lets you check and replace links sitewide. And the outline view displays the tag structure of individual pages in an Explorer-like tree view, making GoLive a natural for structured XML authoring.

Unfortunately, GoLive's Mac roots are apparent. For example, Apple's QuickTime editor is tightly integrated into GoLive, despite the preference of most Windows users for the RealMedia format. The Objects Palette lets you manage Apple's DHTML-based WebObjects, but these features require Web sites to be hosted on an Apple server. And while GoLive imports Windows-based Active Server Pages (ASP), it doesn't help build them.

Although Adobe still has a lot of work to do, GoLive will instantly give the company's Web authoring lineup a heavy hitter. (Adobe Systems Inc., San Jose, CA; 800-685-3612; www.adobe.com.)—EM

advanced page components, including an ad banner manager, a hit counter, and hover buttons, as well as scheduled image and page substitutions. Most of these features require FrontPage Server Extensions, which can be downloaded for free from Microsoft's site. FrontPage's basic database functionality is particularly strong. It can create and install an Access database from a form, and it includes templates for both employee databases and product catalogs.

As you build your site, FrontPage aggregates all the necessary files, making both full-site and incremental uploads extremely simple. And new reports

shared borders, editable styles, and flexible navigation bars makes maintenance as painless as possible.

High-end designers may want the fine control afforded by Dreamweaver, but most users will find FrontPage offers everything they need to create and maintain professional-looking Web sites.—JO

NetObjects Fusion 4.0

\$300 street. NetObjects Inc., Redwood City, CA; 888-449-6400, fax 650-482-3200; www.netobjects.com.

● NetObjects Fusion was the first product to offer pixel-level positioning of objects on Web pages, bringing the power of desktop publishing to the Web authoring world. Since then, Fusion has evolved into a top-notch authoring and site management tool suitable for a broad range of developers, although novices may be deterred by the \$300 price tag. Aside from a few weaknesses, NetObjects Fusion 4.0 delivers everything you'd expect and, as your site grows, a whole lot more.

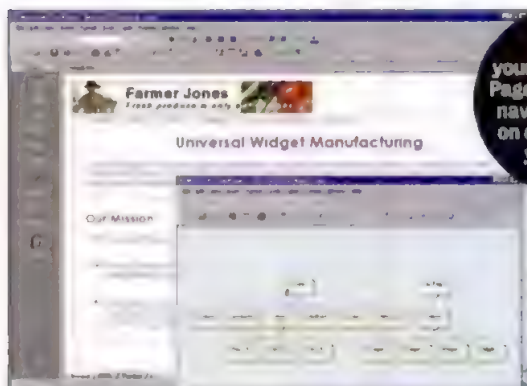
You start your site with either a blank page or a template that contains a super-set of default pages including FAQ, contact information, and site map pages.

Using the Site view, which arranges your pages into an organization chart, you organize the pages and discard the ones you don't need. Fusion also offers more than 50 editable styles that are generally better suited to corporate sites than the more flashy design templates found in Microsoft FrontPage 2000.

You design your pages in Fusion's Page view. By default, pages include MasterBorders, which are regions of the edges of the page that contain elements that appear repeatedly throughout the site, such as a left-column navigation bar or an ad banner at the top of the page. (MasterBorders convert easily to frames.) The center of the page, where the freshest content usually appears, is the layout region.

To add new elements such as text and graphics, you draw a destination box and then type or select the corresponding content. Each element has a properties box that controls its display and link properties. Unfortunately, it's not as easy to create pages using existing content. We were unable to import Word documents, and when we cut and pasted a page from a Web browser, Fusion failed to capture the graphics. Furthermore, when we imported HTML files, Fusion mangled them so badly that we had to do a lot of cleanup.

Though improved from previous versions, Fusion's table editing still trails that of FrontPage 2000 and Macromedia's



include the ability to detect broken hyperlinks and identify old or slow pages. You may appreciate FrontPage most when it's time to modify your site, however, because its combination of

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Model	Standard L700	MSRP Recommended 1510W	MSRP Recommended 1510
Viewable Image Size	15.1"	15.0"	15.0"
1,024 x 768 Max. Resolution	Yes	Yes	Yes
Contrast Ratio	200:1	200:1	100:1
16 Million Colors	Yes	Yes	Yes
120 Degree Viewing Angle	Yes	No	Yes
150°/90° Swivel	Yes	Yes	Yes

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Dreamweaver 2. Its method of previewing pages is another weakness. Since the program has to generate the required HTML pages and then spawn an external browser, this process can be time-consuming with complex sites.

Fusion does, however, offer some fairly powerful advanced design capabilities. Fusion now lets you output pages using CSS or nested tables. Furthermore, it offers a range of interactive effects, including image rollovers, page transitions, and a variety of Java effects. Notably, you can rotate images and ad banners, create drop-down lists for navigation, and produce tickertapes with hyperlinks.

You can select the level of browser that your output will support, and the program warns you when DHTML effects may not work in target browsers. You can also create pages optimized for different browsers and then query the remote browser and send the appropriate page.

We were able to input and play QuickTime and RealMedia files but not Microsoft NetShow files. Database connectivity is particularly strong; Fusion even has links to iCAT's Commerce Server.

During development, Fusion automatically tracks external assets for you and can verify internal and external links before publishing. The program manages the upload process well and can be set to send only changed pages. Another strong feature is Fusion's ability to manage site changes. Attributes such as fonts, buttons, and background graphics can be modified site-wide by altering the style. You can even modify the layout of multiple pages or the entire site by editing the MasterBorders. In addition, whenever you add or remove pages from the site, Fusion automatically updates the navigation bars on each page.

On the whole, Fusion provides a useful array of site development and management features. Provided you plan your site well, maintaining and updating it should be very easy with Fusion.—JO

Visual Page 2.0

\$99 list; upgrade, \$49.95. Symantec Corp., Cupertino, CA; 888-411-7234, 541-334-6054; www.symantec.com.

● Symantec's Visual Page 2.0 is designed for beginners who want to build and

upload graphics-rich Web sites. But despite delivering some useful features, such as simple WYSIWYG tools for creating frames and Cascading Style Sheets, Visual Page lacks some rudimentary features. And its main editing interface is cluttered and outdated.

To begin a project, you can import an existing site or build one from scratch. But Visual Page doesn't include site templates; instead, the program provides only a set of sample files.

A Project window lists all files used in the current site and detects whether any links to files within the site are broken (Visual Page cannot verify hyperlinks to external targets, so these are always listed as valid). When you repair one instance of a broken link by hand, all other instances of the link within your site

warns that layers "work best in the 4.x browsers," actually they work *only* in 4.x and later versions. Furthermore, Visual Page fails to warn users if the output files will display incorrectly in any browsers. Visual Page doesn't support DHTML.

Rather than organizing the site management and editing tools separately, Visual Page relies on the multitude of subwindows that pop up as you work. The result is an interface that can become quite cluttered; at times we found ourselves using the drop-down Window menu to locate files already opened on the screen.

Visual Page can't import Microsoft Word files. The program does let you import HTML documents from a local disk or remote server, but we ran into a few problems. For instance, the program

moves the closing tag of a form to the foot of the page, even if it was carefully placed somewhere else. In most cases this is a minor annoyance, but it can cause serious problems if you insert another form on the same page using a different program.

The Project window doubles as a simple FTP client that can upload one or more files as well as publish an entire site.

are automatically repaired. Visual Page doesn't generate navigation bars.

To edit pages, Visual Page includes both a WYSIWYG window and a code window. You can work on the same page in both windows simultaneously, but changes made in one aren't reflected in the other until you switch between windows.

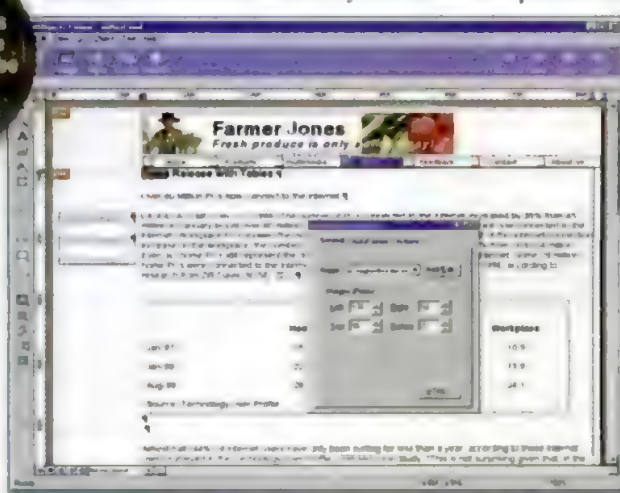
Visual Page's preview mode uses a proprietary browser. But since this preview browser (which supports Java but not JavaScript) fails to represent any real-world browser, you'll want to preview your work with both Microsoft Internet Explorer and Netscape Navigator. We did like how Visual Page displays Java applets "live" in the Project window, however.

Visual Page lets you precisely place graphics on the page using CSS positioning—a feature that Symantec calls EZLayer. Although the read-me file

When you upload files, the program asks if you want to replace remote files. If you choose the Publish option, however, remote files are overwritten without warning.

The Live Update wizard automatically downloads and installs program upgrades. But the service falsely reported that we had the most recent version of Visual Page even though an update (Version 2.0a) was available—a problem Symantec acknowledged. Even with the update, some annoying bugs persist. For example, the Hide Java Console command sometimes expands the console to full-screen rather than hiding it.

Visual Page has a few notable features, but the product simply hasn't kept up with the more sophisticated WYSIWYG editors on the market, such as Microsoft FrontPage 2000 and NetObjects Fusion 4.0.—EM PC





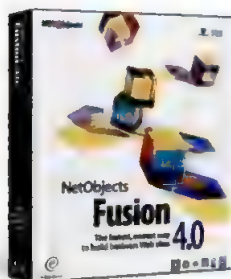
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e-business

JANE WALL STREET

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POLISH it

With the ever-increasing number of new business Web pages being erected on the Internet daily, your little slice of cyberspace can easily get lost in the shuffle. Fortunately, the need to rise above the noise has spawned a number of free or inexpensive tools and services designed to help small-business sites get noticed, market their wares to their user base, or simply look more professional.

Web services were once the province of single-service sites, such as banner exchange programs, Web search submission engines, and mailing list services. Today they're provided by megastores that can help your site generate cash with affiliate programs and Web-front e-commerce, track visitor traffic patterns, and ensure site integrity with link verification and spell-checking.

The first step in getting the word out about your site is to register with the major search engines such as Yahoo! and Excite. These are still the first places most users go to find what they need on the Internet. The services we review can register you with the more than 400 search engines and directories that index Web content. Here, customization is key, because all search engines require different information and ignore or reject non-conforming submissions. Equally important are tools that monitor search engine ranking over time, so you'll know when to resubmit your information to land higher in the search returns for your target keywords.

Another promotional tack is signing up for a banner exchange, a program that displays your ad banners on remote sites in exchange for displaying ad banners on your pages. Having banners on your site can make it look more profes-

sional and may attract surfers who might not otherwise visit your site.

Once you start attracting visitors, the trick is to convert them into *repeat* visitors. One way to do this is to use a mailing list service that lets visitors sign up for periodic e-mail updates about your site. Look for a service you'll be able to grow with, one that has management features such as reporting bounced-back e-mail and the ability to import existing mailing lists. One of the most valuable tracking tools for mailing lists can tell you the number of list members who click through to your site from a URL contained in one of your mailings.

Keeping your site fresh costs time and money, so you may also want to find ways to convert browsers into buyers to help defray those costs. The four megastores we review here can help you make money on your site in two ways: through direct sales (via e-commerce) and commissions (via affiliate programs). Their e-commerce capabilities let you set up a simple store on your site. The affiliate programs let you market products available on another site to your visitors, earning commissions for click-throughs, leads, or sales. Some affiliate programs are run by major Web commerce sites such as Amazon.com and Beyond.com, others by lesser-known sites selling a wide variety of products. You can even create your own affiliate program to market your product or service.

Beyond the megastore sites, other single-purpose sites offer features such as maps and even free, Web-based e-mail for your visitors, that can give your site that professional look (see "...And for the Final Polish").

As any Web site entrepreneur will attest, there's no easy way to get a fledgling Web business off the ground and profitable. You don't have to spend a fortune to reap benefits, however. You just have to do the work—or find a service to do it for you.

BY JAN OZER

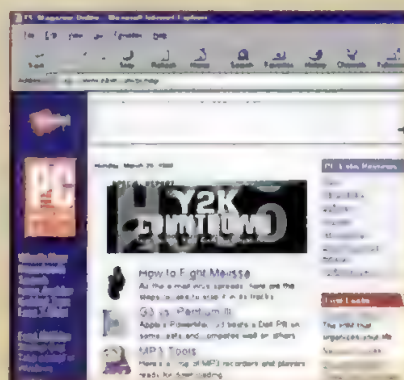


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BUILD A WEB BANNER AD

Technology alone can't help you design an effective banner ad for the Web. You still need a hook—clever words or a compelling image—to grab the reader's attention. Here, we've used Macromedia Fireworks (a dedicated Web graphics program) to generate an animated GIF banner. But most image-editing programs (such as Adobe Photoshop) can output the GIF 89a format. And you can find freeware (like Microsoft GIF Animator) to compile a series of still images into an animation.

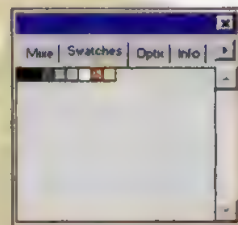


1 BEFORE YOU BEGIN Determine the ad's exact image dimensions (measured as pixel width by pixel height) and maximum allowable file size (typically 12K or less). Many Web sites won't accept advertising that exceeds their limits.

2 DEVELOP THE CONTENT Using old-fashioned pencil and paper, sketch out the image, or in the case of an animation, storyboard the action. Keep the copy brief and the images simple.

3 CREATE THE ELEMENTS Generate the text and pictures. Always design with the file size in mind. Try to use solid colors and simple graphics elements, because they compress better than patterns and photographs. Create a custom Web-safe palette containing only a few colors to reduce the file size further.

Need It Now?
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HyperBanner

www.hyperbanner.com

● If your goal is to attract an international crowd to your Web site, HyperBanner is the megastore for you. It's the only service we tested to offer locally run foreign-country banner networks. But for targeting domestic business only, rival services have more extensive offerings. In either case, you'll have to find another provider for mailing list management, e-commerce, and search engine submission, because HyperBanner doesn't offer any of these services.

Like all the services we review here, HyperBanner uses a 2:1 ratio in its banner exchange, meaning that for every two banners displayed on your site, your banner will be displayed once on another site.

HyperBanner's general U.S. service has only 20 categories, including computers, government, and sports. These general categories are far fewer than MSN LinkExchange's 300, making it harder to target your banners effectively. HyperBanner also lacks a mechanism like SmartAge's Smart

Targeting, which identifies well-performing categories as measured by click-throughs. With 130,000 Web sites, HyperBanner trails both SmartAge (150,000) and LinkExchange (450,000) in reach.

In addition to its U.S. service, HyperBanner offers identical services for 34 foreign countries, such as Germany and Japan. Its foreign services are run locally, making them ideal for

businesses operating in or targeting these markets, because the local administrators ensure that all of the Web sites in HyperBanner's countries are properly categorized and translated.

As with LinkExchange, you can exclude specific categories from displaying banners on your site, so your competitor's ad isn't likely to show up on your page. But

HyperBanner is the only service that honors requests to exclude banners from specific URLs and guarantees it. To reward sites that drive traffic to yours, HyperBanner ranks the number of click-throughs of member sites and displays your banners on sites with equivalent rankings.

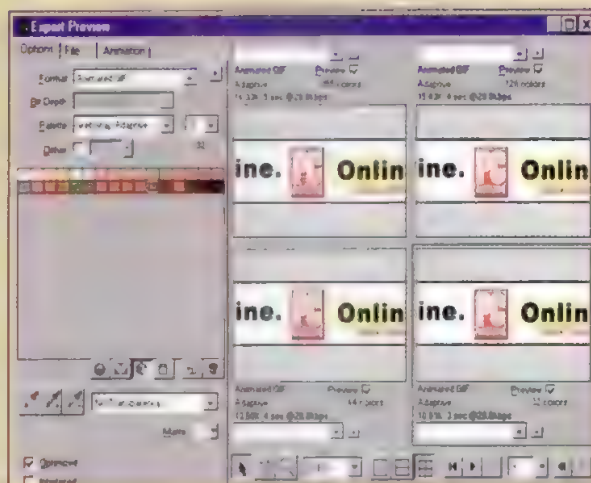
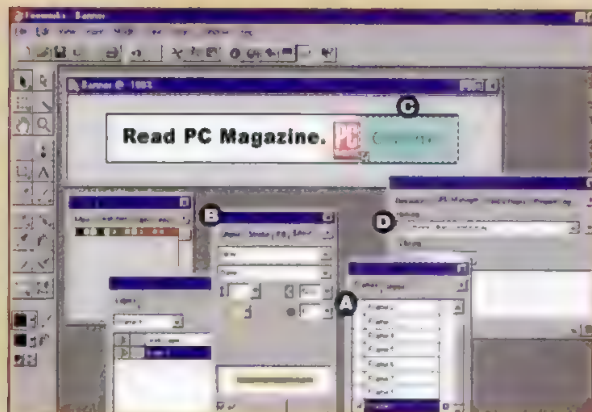
HyperBanner lets you run more than one banner (such as banners with different looks or promoting different things at your site) simultaneously from your account and offers banner-specific statistics to make gauging banner effectiveness easy. And only HyperBanner sends e-mail reports to members; others require that you visit their sites to view this data. HyperBanner is also the only service to offer performance graphs, although they're not e-mailed; you must visit its site to see them.

HyperBanner's affiliate program, called Cash-it, is run by Refer-it (for more information, see our table "Affiliate Programs") which includes more than 500



Our Contributors: JAN OZER and LUISA SIMONE are contributing editors of *PC Magazine*. KEVIN CARDANY is a freelance writer. BEN Z. GOTTESMAN is a technical director at PC Magazine Labs, and staff editor DOUG BEIZER was in charge of this story.

4 COMPOSE THE AD If you are generating a single static image, layout is a simple process. For a GIF animation, determine the number of frames (A) and create an animated effect (keep it simple!). An animated glow (B) or color change will compress more efficiently than a motion or zoom effect. Finally, add a hot spot (C) that points to your Web site or e-mail address (D), so you can get immediate reader response.



5 OPTIMIZE FOR THE WEB Preview the ad, and if necessary, reduce the frame count or the number of colors to meet the target file size. Take

advantage of features unique to the GIF format such as transparency and interlacing. Save the final GIF file and the associated HTML code.

WRITTEN BY LUISA SIMONE

affiliates in more than 40 categories. LinkExchange has 3,500 affiliate merchants, and SmartAge's affiliate partner LinkShare has more than 65,000.

HyperBanner offers other useful features, including a simple visitor counter and tools that let you host games or conduct polls on your site.

On the whole, HyperBanner's most valuable feature is its ability to run banner ads on international sites. If going global is not part of your business plan, other banner programs will serve you better.

MSN LinkExchange

www.linkexchange.com



A one-stop shop is most valuable when it provides quality merchandise, which is what you get with MSN LinkExchange. It offers an invaluable range of polished, focused, and accessible services. LinkExchange makes it a snap to integrate e-commerce services into your existing site. And its free and fee-based mailing list programs outshine those of the rest of the pack. If you're a small business seeking to maximize your site's exposure and profitability, LinkExchange should be your first stop.

With 450,000 member sites, LinkExchange's banner exchange network is the largest. It even lets you target U.S.-only sites or sites in 32 foreign countries. Note,

however, that the foreign networks aren't operated and maintained by a local staff, as HyperBanner's foreign networks are.

MSN LinkExchange provides over 300 target categories—such as Internet training, education, and computers—for banner display. SmartAge, by comparison, has only 38 categories. You are limited to

one banner per account, though (unlike with HyperBanner), which complicates the rollout and testing of new banners.

LinkExchange lets you block particular categories from appearing on your site, so you'll be less likely to display your competitors' banners. Unlike HyperBanner, LinkExchange doesn't provide

EDITORS' CHOICE

MSN LinkExchange



A Web site isn't worth much if no one sees it or visits on a regular basis. The megastore that provides the best tool set to help you promote your site and make money

from it is MSN LinkExchange, which thus earns our Editors' Choice.

While other sites may offer comparable tools, LinkExchange offers everything under one umbrella, and its tools are excellent. This full-service richness is the reason you should go to LinkExchange first.

LinkExchange offers great promotional tools with its banner ad exchange program, mailing list service, and search engine registration and ranking service. It has the most

extensive banner exchange network of all the megasites, along with more than 300 target categories. It also provides a breadth of categories to help ensure that you reach your target audience.

SmartAge earns an honorable mention for its breadth of tools and especially its Smart Targeting feature. Smart Targeting monitors your banner ad's click-through performance within SmartAge's 38 categories, dynamically shifting your banner towards more successful categories.

Web Site Enhancements

e-mail reports or graphs, and its on-site data is modest, with daily, weekly, and monthly statistics of visits, exposure, and click-throughs.

LinkExchange offers two mailing list services, the advertising-supported ListBot, which has unlimited messages, and the ad-free ListBot Gold, which costs \$99 a year for up to 5,000 messages per month. The ads in ListBot are simply text messages within the e-mails. The Gold service also enables messages of up to 250K (compared with 100K for the free service) and lets you import existing mailing lists. You can't personalize messages or track URL click-throughs, however; both are critical marketing-oriented features offered only by WebSite Garage's WebSite Post Office.

But if you want to pursue revenue, LinkExchange has a lot to offer. You can easily integrate e-commerce capabilities into your existing Web site. Just upload your product list online; then a simple HTML link on your products page adds an item to the shopping cart that exists on LinkExchange's server. That way the store is on your page, but the back end is handled by LinkExchange. SmartAge's e-commerce solution, iCat's Commerce Online, bounces your customers to iCat's Web site to buy your goods. LinkExchange's e-commerce services cost \$150 to set up plus monthly charges of 2 percent of sales or \$35, whichever is greater. Credit card and CyberCash authorization cost extra.

LinkExchange also offers a number of well-indexed affiliate programs, detailing payment data and number of current affiliates enrolled. All programs are separately administered, unlike the third-party affiliate programs that SmartAge and



To test the Web site tools and services, we used live Web pages, focusing on tools that help drive traffic to a site and those that help make money.

For the banner advertising exchange programs, we joined the networks and ran advertisements on our page. Our ads, in

turn, ran on other pages in the networks.

To test e-mail list services, we created a mailing list and generated messages, verified that the mail arrived at its destination, and examined management features.

To test search engine submission services, we went through the entire submission process, focusing on configurability and tools that show you where your site is ranked in various search engines.

EDITORS' CHOICE

	HyperBanner	MSN LinkExchange	SmartAge	WebSite Garage
BANNER ADS				
Exchange ratio	2:1	2:1	2:1	N/A
Network size	>130K	400K	100K	N/A
Reporting and statistics	Good	Good	Excellent	N/A
Placement categories	Excellent	Excellent	Good	N/A
Sign-up process	Good	Excellent	Good	N/A
E-COMMERCE				
Number of affiliate merchants	435	3,500	65,000	None
Affiliate program sign-up/setup	Good	Excellent	Excellent	N/A
Store-building help	N/A	Excellent	Excellent	N/A
Store-building power	N/A	Excellent	Excellent	N/A
Web store support	N/A	Excellent	Excellent	N/A
MAILING LISTS				
Registration	N/A	Excellent	N/A	Excellent
Ease of e-mail address collection	N/A	Excellent	N/A	Excellent
Send options	N/A	Excellent	N/A	Excellent
List management	N/A	Excellent	N/A	Good
SEARCH ENGINE REGISTRATION AND RANKING				
Price	N/A	\$80.00	\$9.99	\$39.99
Number of engines and directories	N/A	400	400	400
Registration	N/A	Excellent	Fair	Good
Tracking	N/A	Excellent	Good	N/A

N/A—Not applicable. The product does not have this feature.

HyperBanner use, which offer centralized accounting to simplify record keeping.

LinkExchange offers two free search-engine registry services (Submit It! Free and Submit It! Free Classic), along with one fee-based service that costs \$59 per year. As you might guess, the latter is far more flexible, letting you register two URLs on more than 400 search engines.

There's even a tracking tool, Position Agent (\$60 for six months), which can track five keywords on the ten leading search engines, with weekly reports and online charts.

Because LinkExchange provides an affordable range of services that will benefit virtually all small-business Web sites, it should be your starting point for Web site improvement.

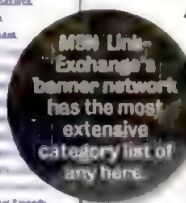
SmartAge

www.smartage.com

● In many ways, SmartAge lives up to its name. The jewel in its crown, a feature called Smart Targeting, monitors your banner ad's click-through performance within the program's 38 target categories, dynamically shifting your banner towards more successful categories. No other site offers a comparable feature. And no other site aggregates so many third-party services.

Smart Targeting is an innovative approach that works well for mass market products. But niche marketers may prefer the granularity of MSN LinkExchange's 300-plus target categories.

In addition, you can experiment with categories and see which ones produce the best results. But you can't easily experiment with different-looking ban-



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- NEW 6X Max¹⁰ Variable DVD-ROM
- Turtle Beach Montego II A3D™ 320V Sound Card
- harman/kardon HK-195 Speakers
- 100MB Iomega Zip BUILT-IN Drive
- MS® Office 97 SBE plus Bookshelf (Ask about Our FREE MS Office 2000 Upgrade Offer); McAfee VirusScan
- MS Windows[®] 98/IntelliMouse[®]
- Dell QuietKey[®] Keyboard
- 3-Year Limited Warranty²
- 1-Year NBD On-site³ Service

\$2599

Business Lease¹⁵: \$87/Mo., 36 Mos.

 E-VALUE CODE: 04090-590525a

NEW DELL DIMENSION XPS T550 PENTIUM III PROCESSOR AT 550MHz

- 96MB 100MHz SDRAM
- NEW 9.1GB⁴ Ultra ATA Hard Drive (7200 RPM)
- 17" (16.0" vis., .26dp) M780 Monitor
- 8MB ATI XPERT 98D 3D AGP Graphics
- 40X Max⁵ Variable CD-ROM Drive
- Yamaha XG 64V Wavetable Sound
- MS Office 97 SBE plus Bookshelf (Ask about Our FREE MS Office 2000 Upgrade Offer); McAfee VirusScan
- MS Windows 98/IntelliMouse
- Dell QuietKey Keyboard
- 3-Year Limited Warranty²
- 1-Year NBD On-site³ Service
- ★ Upgrade to a 19" (18.0" vis., .26dp) Trinitron P990 Monitor, add \$259.
- ★ harman/kardon HK-195 Speakers, add \$25.

\$1999

Business Lease¹⁵: \$67/Mo., 36 Mos.

 E-VALUE CODE: 04090-590519a

NEW DELL DIMENSION XPS T450 PENTIUM III PROCESSOR AT 450MHz

- 64MB 100MHz SDRAM
- NEW 9.1GB⁴ Ultra ATA Hard Drive (7200 RPM)
- 17" (16.0" vis., .26dp) M780 Monitor
- 8MB ATI XPERT 98D 3D AGP Graphics
- 40X Max⁵ Variable CD-ROM Drive
- Yamaha XG 64V Wavetable Sound
- MS Office 97 SBE plus Bookshelf (Ask about Our FREE MS Office 2000 Upgrade Offer); McAfee VirusScan
- MS Windows 98/IntelliMouse
- Dell QuietKey Keyboard
- 3-Year Limited Warranty²
- 1-Year NBD On-site³ Service
- ★ Upgrade to 96MB 100MHz SDRAM, add \$59.
- ★ Upgrade to a 17" (16.0" vis., .26dp) 1000HS Trinitron Monitor, add \$99.

\$1499

Business Lease¹⁵: \$50/Mo., 36 Mos.

 E-VALUE CODE: 04090-590514

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- HP DeskJet 710 All-in-One, add \$499.
- HP LaserJet® 1100se Printer, add \$399.
- Dragon NaturallySpeaking Preferred (Speech Recognition Software), add \$149.
- 3Com Palm III, add \$319.
- HP SureStore CD-Writer Plus 7200E, add \$388.

DELL DIMENSION V400c INTEL CELERON® PROCESSOR AT 400MHz

- 64MB SDRAM
- 6.4GB⁴ Ultra ATA Hard Drive
- 17" (16.0" vis., .26dp) M780 Monitor
- 8MB ATI 3D AGP Graphics
- 32X Max⁶ Variable CD-ROM Drive
- Yamaha XG 64V Wavetable Sound
- harman/kardon HK-195 Speakers
- 3Com 3C905B 10/100 NIC
- MS Office 97 SBE plus Bookshelf (Ask about Our FREE MS Office 2000 Upgrade Offer); McAfee VirusScan
- Microsoft® Windows 98
- Dell QuietKey Keyboard
- Logitech First Mouse+ Wheel (PS/2v)
- 3-Year Limited Warranty²
- 1-Year NBD On-site³ Service
- ★ Upgrade to a NEW 9.1GB Ultra ATA Hard Drive (7200 RPM), add \$29.

\$1299

Business Lease¹⁵: \$44/Mo., 36 Mos.

 E-VALUE CODE: 04090-590512

DELL DIMENSION V400c INTEL CELERON PROCESSOR AT 400MHz

- 32MB SDRAM
- 4.3GB⁴ Ultra ATA Hard Drive
- 15" (13.8" vis.) 800F Monitor
- 8MB ATI 3D AGP Graphics
- 32X Max⁶ Variable CD-ROM Drive
- Integrated Intel 10/100 Ethernet Controller
- Microsoft Works Suite 99 with Money 99 Basic; McAfee VirusScan
- Microsoft Windows 98
- Dell QuietKey Keyboard
- Logitech First Mouse+ Wheel (PS/2v)
- 3-Year Limited Warranty²
- 1-Year NBD On-site³ Service
- ★ Upgrade to the Small Business Solutions Bundle, add only \$155. NEW Dimension V433c: Intel Celeron Processor at 433MHz, 6.4GB Ultra ATA Hard Drive, MS Office 97 SBE plus Bookshelf, McAfee VirusScan

\$999

Business Lease¹⁵: \$33/Mo., 36 Mos.

 E-VALUE CODE: 04090-590509

POWER UPGRADES

- 100MB Iomega Zip BUILT-IN Drive with Two Disks, add \$99.
- 250MB Iomega Zip BUILT-IN Drive with One Disk, add \$149.
- 100MB Iomega Zip Disk 6-Pak, add \$63.
- 3Com 3C905B 10/100 NIC, add \$49.
- 3Com USRobotics V.90¹¹ PCI Telephony WinModem, add \$49.
- Intuit QuickBooks 99, add \$118.
- Intuit QuickBooks Pro 99, add \$215.
- Upgrade to Microsoft Windows NT[®] Workstation 4.0, add \$99.
- Upgrade from Microsoft Office 97 Small Business Edition to Microsoft Office 97 Professional Edition, add \$199.
- 3-Year Next-Business-Day On-site³ Service, add \$99.
- Upgrade from a 17" (16.0" vis., .26dp) M780 Monitor to a 17" (16.0" vis., .26dp) 1000HS Trinitron Monitor, add \$99.

DELL DIMENSION AWARD INFO

- In 1998, Dell Dimension desktops won more than 90 product and service awards. See www.dell.com/awards98 for details.

Advertised configurations vary from award-winning configurations

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DELL INSPIRON™ 7000 A366LT PENTIUM® II PROCESSOR AT 366MHz

Desktop Features, Notebook Convenience

- 15" XGA Active Matrix Display
- 96MB SDRAM
- NEW 14GB⁴ Ultra ATA Hard Drive
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- 2X AGP 8MB ATI RAGE™ LT Pro 3D Video
- 3D Surround Sound with Wavetable
- Lithium Ion Battery
- 56K Capable¹¹ x2 Modem with Trial Offer ConnectDirect™ Internet Access¹⁴
- MS® Office 97 SBE (Ask about Our FREE MS Office 2000 Upgrade Offer)
- Microsoft® Windows® 98/Touchpad
- APC Notebook Surge Protector
- 3-Year Limited Warranty²

\$3799

Business Lease¹⁵: \$127/Mo., 36 Mos.

 **E-VALUE CODE: 04091-890537**

DELL INSPIRON 7000 A366GT PENTIUM II PROCESSOR AT 366MHz

Desktop Features, Notebook Convenience

- 14.1" XGA Active Matrix Display
- 64MB SDRAM
- 4.3GB⁴ Ultra ATA Hard Drive
- Removable Combo 24X Max⁷ Variable CD-ROM and Floppy Drive
- 2X AGP 4MB ATI RAGE LT Pro 3D Video
- 3D Surround Sound with Wavetable
- Lithium Ion Battery
- 56K Capable¹¹ x2 Modem with Trial Offer ConnectDirect Internet Access¹⁴
- MS Office 97 SBE (Ask about Our FREE MS Office 2000 Upgrade Offer)
- NEW Microsoft Windows NT® Workstation 4.0/Touchpad
- 3-Year Limited Warranty²

\$2799

Business Lease¹⁵: \$90/Mo., 36 Mos.

 **E-VALUE CODE: 04091-890527**

NEW DELL INSPIRON 7000 A300LT PENTIUM II PROCESSOR AT 300PE MHz

Desktop Features, Notebook Convenience

- 15" XGA Active Matrix Display
- 32MB SDRAM
- 4.3GB⁴ Ultra ATA Hard Drive
- Removable Combo 24X Max⁷ Variable CD-ROM and Floppy Drive
- 2X AGP 4MB ATI RAGE LT Pro 3D Video
- 3D Surround Sound with Wavetable
- Lithium Ion Battery
- MS Office 97 SBE (Ask about Our FREE MS Office 2000 Upgrade Offer)
- Microsoft Windows 98/Touchpad
- 3-Year Limited Warranty²
- ★ 56K Capable¹¹ Gold Card Global Modem, add \$139.

\$2399

Business Lease¹⁵: \$80/Mo., 36 Mos.

 **E-VALUE CODE: 04091-890523**

DELL INSPIRON 3500 A300GT PENTIUM II PROCESSOR AT 300PE MHz

Light Weight, Light Price

- 14.1" XGA Active Matrix Display
- 32MB SDRAM
- 4.3GB⁴ Ultra ATA Hard Drive
- Modular 24X Max⁷ Variable CD-ROM
- NeoMagic® 256AV AGP Video
- 3D Surround Sound with Wavetable
- Lithium Ion Battery
- Microsoft Works Suite 99 with Money 99 Basic
- Microsoft Windows 98/Touchpad
- 3-Year Limited Warranty²
- ★ 3-Year NBD On-site³ Service, add \$99.
- ★ Upgrade to 64MB SDRAM, add \$99.

\$1999

Business Lease¹⁵: \$67/Mo., 36 Mos.

 **E-VALUE CODE: 04091-890519**

NEW DELL INSPIRON 3500 C333XT INTEL® CELERON™ PROCESSOR AT 333MHz

Light Weight, Light Price

- 13.3" XGA Active Matrix Display
- 32MB SDRAM
- 4.3GB⁴ Ultra ATA Hard Drive
- Modular 24X Max⁷ Variable CD-ROM
- NeoMagic 256AV AGP Video
- 3D Surround Sound with Wavetable
- Lithium Ion Battery
- Microsoft Works Suite 99 with Money 99 Basic
- Microsoft Windows 98/Touchpad
- 3-Year Limited Warranty²
- ★ 3Com® 10/100 Fast Ethernet Adapter, add \$129.

\$1799

Business Lease¹⁵: \$60/Mo., 36 Mos.

 **E-VALUE CODE: 04091-890517**

DELL LATITUDE® CPi A366XT SMALL BUSINESS SOLUTION PENTIUM II PROCESSOR AT 366MHz

Network-Optimized Notebook

- 13.3" XGA Active Matrix Display
- 96MB SDRAM (256MB Max)
- 4.3GB⁴ Ultra ATA Hard Drive
- Modular 24X Max⁷ Variable CD-ROM
- Modular Floppy Drive
- NeoMagic 256AV AGP Video
- 3D Surround Sound with Wavetable
- Lithium Ion Battery
- MS Office 97 SBE (Ask about Our FREE MS Office 2000 Upgrade Offer)
- MS Windows NT Workstation 4.0/Touchpad
- 3-Year Limited Warranty²
- Deluxe Nylon Case

\$3199

Business Lease¹⁵: \$107/Mo., 36 Mos.

 **E-VALUE CODE: 04091-790531**

DELL LATITUDE CPi A300ST PENTIUM II PROCESSOR AT 300PE MHz

Network-Optimized Notebook

- 12.1" SVGA Active Matrix Display
- 64MB EDO RAM (256MB Max)
- 4.3GB⁴ Ultra ATA Hard Drive
- Modular 24X Max⁷ Variable CD-ROM
- Modular Floppy Drive
- NeoMagic 256AV AGP Video
- 3D Surround Sound with Wavetable
- Lithium Ion Battery
- MS Windows NT Workstation 4.0/Touchpad
- 3-Year Limited Warranty²
- 1-Year NBD On-site³ Service
- ★ Upgrade to 96MB EDO RAM, add \$99.

\$2399

Business Lease¹⁵: \$80/Mo., 36 Mos.

 **E-VALUE CODE: 04091-790523**

DELL NOTEBOOK AWARD INFO

- Inspiron 7000 A366LT – PC Magazine's Editors' Choice for small businesses, 1/99.
- Inspiron 3500 C300XT – PC World's Best Buy in the budget category, 4/99.

Advertised configurations vary from award-winning configurations

GigabuyTM for Notebooks

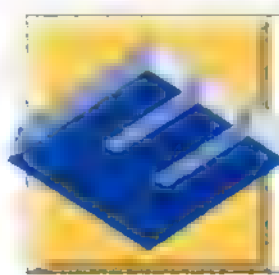
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- NEW 100MB Zip Internal Drive for Latitude CP & CPi (Win95/98), add \$199.
- Notebook Conversion Package, including Black ViewSonic 17" (16.0" viewable) Multimedia Monitor, ErgoMouse and Keyboard, add \$429.
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- Canon BJC-50 Portable Printer, add \$349.



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Whether it's communicating via e-mail, going online, sharing printers or accessing the latest data, your company is probably dependent on servers. For about the price of some desktop computers, you can get the new affordable Dell® PowerEdge® 1300 server.

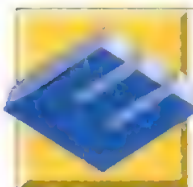
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Designed for added reliability, try our PowerEdge 2300 server. Ideal for the growing business, this dual processor capable server can host up to six hot swap hard drives. Designed for business critical reliability and power, Dell offers the PowerEdge 4300 and 6300 servers with hot-swap redundant power supplies and cooling fans. So go to www.dell.com today and start making the most of your people.

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- Three 9GB¹ (10,000 RPM) Ultra-2/LVD SCSI Hot-Swap Hard Drives
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- HP® OpenView™ NNM Special Edition
- Two Intel® Pro/100+ PCI Ethernet Adapters with Adaptive Fault Tolerance Software
- Integrated Dual Ultra-2/LVD and Ultra/Narrow SCSI Controllers
- Redundant Hot-Swap Power Supplies, Cooling Fans and Processor Fans
- 7 Expansion Slots: (4) 64-bit, (3) 32-bit PCI
- 8-1" Hard Drive Bays/4-5.25" Media Bays
- 3-Year NBD On-site³ Service
- 1-Year DirectLine™ NOS Support
- 7x24 Dedicated Server Hardware Technical Telephone Support

\$12,549

Business Lease¹⁵: \$414/Mo., 36 Mos.

 E-VALUE CODE: 04092-290501

DELL POWEREDGE 4300 SERVER PENTIUM II PROCESSOR AT 400MHz (DUAL PROCESSOR/RAID CAPABLE)

- 256MB 100MHz ECC SDRAM
- 9GB¹ Ultra-2/LVD SCSI Hard Drive (Hot-Swap Optional)
- HP OpenView NNM Special Edition
- Two Intel Pro/100+ PCI Ethernet Adapters with Adaptive Fault Tolerance Software
- Integrated Ultra-2/LVD and Ultra/Narrow SCSI Controllers
- Redundant Hot-Swap Power Supplies, Cooling Fans and Processor Fans
- 12/24GB Variable SCSI DAT Tape Backup Unit
- 6 Expansion Slots: 4 PCI, 2 PCI/ISA
- 6-1.6" Hard Drive Bays/4-5.25" Media Bays
- 3-Year NBD On-site³ Service
- 1-Year DirectLine NOS Support
- 7x24 Dedicated Server Hardware Technical Telephone Support

\$5949

Business Lease¹⁵: \$199/Mo., 36 Mos.

 E-VALUE CODE: 04092-290559

DELL POWEREDGE 2300 SERVER NEW PENTIUM III PROCESSOR AT 500MHz (RAID 5 CONFIGURATION)

- 256MB 100MHz ECC SDRAM
- Three 9GB¹ Ultra-2/LVD SCSI Hot-Swap Hard Drives
- Ultra-2/LVD PowerEdge Expandable RAID Controller 2/Single-Channel
- HP OpenView NNM Special Edition
- Intel Pro/100+ PCI Ethernet Adapter
- Integrated Ultra-2/LVD and Ultra/Narrow SCSI Controllers
- 6 Expansion Slots: 4 PCI, 2 PCI/ISA
- 6-1" Hard Drive Bays
- 4 Media Bays: 3-5.25", 1-3.5"
- 3-Year NBD On-site³ Service
- 7x24 Dedicated Server Hardware Telephone Technical Support
- ★ APC Smart-UPS 700W Power Supply, add \$369.

\$5499

Business Lease¹⁵: \$184/Mo., 36 Mos.

 E-VALUE CODE: 04092-290554

INTRODUCING DELL NETWORKS™ INSTALLATION SERVICES FOR YOUR NETWORKING NEEDS

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- Peripheral Installation
- Network Cabling Installation
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TODAY TO CUSTOMIZE
YOUR NETWORK.

Must purchase a PowerEdge server to be eligible for installation services

DELL SERVER AWARD INFO

- *Network World* "World Class Award" – Dell PowerEdge 2300, 6/98.
- *Computer Shopper* "Top 100" – Dell PowerEdge 2300, 11/98.
- *PC Computing's* "The 'A' List" – Dell PowerEdge 6300, 11/98.
- *LANTimes* "The Best of LANTimes Over \$25,000" – Dell PowerEdge 6300, 9/98.
- *ComputerWorld's* "Leaders' Choice" Winner Workgroup Servers – Dell PowerEdge Family, 1/98.

Advertised configurations vary from award-winning configurations

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DELL POWEREDGE 2300 SERVER NEW PENTIUM III PROCESSOR AT 450MHz (DUAL PROCESSOR/RAID CAPABLE)

- 128MB 100MHz ECC SDRAM
- 9GB¹ Ultra-2/LVD SCSI Hard Drive (Hot-Swap Optional)
- Microsoft® Windows NT® Server 4.0 (10 Client Access Licenses)
- HP OpenView NNM Special Edition
- Intel Pro/100+ PCI Ethernet Adapter
- Integrated Ultra-2/LVD and Ultra/Narrow SCSI Controllers
- 6 Expansion Slots: 4 PCI, 2 PCI/ISA
- 4-1.6" or 6-1" Hard Drive Bays
- 4 Media Bays: 3-5.25", 1-3.5"
- 3-Year NBD On-site³ Service
- 7x24 Dedicated Server Hardware Technical Telephone Support
- ★ 12/24GB Variable SCSI DAT Tape Backup Unit, add \$749

\$3799

Business Lease¹⁵: \$127/Mo., 36 Mos.

 E-VALUE CODE: 04092-290537

DELL POWEREDGE 2300 SERVER PENTIUM II PROCESSOR AT 400MHz (DUAL PROCESSOR/RAID CAPABLE)

- 64MB 100MHz ECC SDRAM
- 4GB¹ Ultra-2/LVD SCSI Hard Drive (Hot-Swap Optional)
- HP OpenView NNM Special Edition
- Intel Pro/100+ PCI Ethernet Adapter
- Integrated Ultra-2/LVD and Ultra/Narrow SCSI Controllers
- 6 Expansion Slots: 4 PCI, 2 PCI/ISA
- 4-1.6" or 6-1" Hard Drive Bays
- 4 Media Bays: 3-5.25", 1-3.5"
- 3-Year NBD On-site³ Service
- 7x24 Dedicated Server Hardware Technical Telephone Support
- ★ MS® Windows NT Server 4.0 (10 Client Access Licenses), add \$799
- ★ Upgrade to a Pentium III Processor at 450MHz, add \$300

\$2349

Business Lease¹⁵: \$79/Mo., 36 Mos.

 E-VALUE CODE: 04092-290523

NEW DELL POWEREDGE 1300 SERVER PENTIUM II PROCESSOR AT 400MHz (DUAL PROCESSOR/RAID CAPABLE)

- 64MB 100MHz ECC SDRAM
- 4GB¹ Ultra-2/LVD SCSI Hard Drive
- HP OpenView NNM Special Edition
- Intel Pro/100+ PCI Ethernet Adapter
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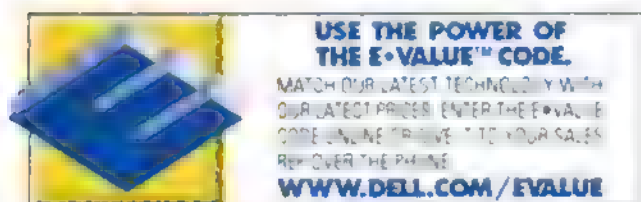
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...AND FOR THE FINAL POLISH

Once your site is up on the Web, you can still do a bit more to put your competitors behind you. From advanced search capabilities to the ability to display maps for your visitors or even broadcast breaking news, these six services (all free except for InfoSpace) may compel visitors to spend more time on your site and also keep them coming back for more.

NET MECHANIC

Broken links and spelling errors are the Webmaster's "ring around the collar," embarrassing signs of lack of attention to detail. Before launching your site, use this service to eliminate both problems. Net Mechanic (www.netmechanic.com) also tests browser compatibility, HTML validity, and page load time. It even has an innovative GIFBot to shrink and optimize online images. But unlike Web Site Garage's fee-based service (www.websitgarage.com), which tests for seven types of errors at one time, Net Mechanic requires you to submit your site separately for each test. On the plus side, Net Mechanic has a customizable spell-checker, so it won't get hung up on names and acceptable jargon.

FREEFIND

Once you've packed your site with valuable reference data, make sure that visitors can easily find what they're looking for. If your HTML authoring program lacks a search engine to plug into your site, you can get free search service from FreeFind (www.freefind.com).

After you register for the service, FreeFind sends a search engine spider to your site to index the data and e-mails you the HTML code to paste into your search page. Though the results page resides on FreeFind's server, you can customize the page to look like your site.

INFOSPACE

The content offered by InfoSpace (www.infospace.com) may be just the thing to get visitors to come back to your site time and time again. For a minimum \$5,000 setup fee plus a monthly maintenance fee, InfoSpace lets you add some or all of its content to your site, including yellow pages, white pages, classifieds, and shopping directories. The co-branding partnership deal lets you add this content, maintaining the look and feel of your site.

MAPQUEST

If you host a steady stream of visitors to your office, check out MapQuest (www.mapquest.com), which can provide online directions in several ways. The easiest is to visit the MapQuest site, enter your address to create a map to your office, save the map using the right mouse click command, then just paste the map into your site.

You can display up to 25 maps on your site free, so long as you display the MapQuest logo linked to the site. Alternatively, you can create a link that takes visitors to the MapQuest site, where they can manipulate the map (zoom in or out, shift in any direction) directly.

ISYNDICATE

Few items grab attention as much as breaking headlines, and you can add them to your Web site with a service offered by iSyndicate (www.isyndicate.com). You design your own breaking news desk, grabbing headlines from ten categories, including sports, technology, or business, from sources such as CBS Sportline and Reuters.

iSyndicate supplies the HTML code and a link to your headline page, though experienced HTML authors can embed headlines in a frame. Either way, visitors can click to the full story, which displays on a page with a banner ad.

ZAPZONE NETWORK

Want to provide free e-mail to your site's visitors? Try ZapZone Network (www.zzn.com). Just complete a few simple forms, paste the HTML code into your page, and upload the page to your site. Your visitor's free e-mail addresses have the suffix zzn.com, added to their chosen name (name@yoursite.zzn.com). The site also provides antispam filters, ICQ integration, spell-checker, folders, mailbox, and the ability to retrieve messages from other POP accounts.

ners, because SmartAge limits you to one active banner per account. (HyperBanner allows multiple banners.) SmartAge does, however, let you change your banner whenever you like, and you can open multiple accounts.

Site integration is straightforward, but you can't block out specific commercial categories, a problem if you want to avoid displaying competitors' banners on your site. Nor does SmartAge ensure that those who display banners prominently on their site (such as in the top 480 pixels of your pages) get equal placement for their banners, a feature that both HyperBanner and LinkExchange offer.

When it comes to reporting, SmartAge is tough to beat. It offers performance statistics for all categories that display your banners, so you can monitor which cate-

gory gives you the best click-through rate.

SmartAge offers iCAT's e-commerce solution, a polished, easy-to-use service that costs \$9.95 a month to sell up to ten items, plus credit card processing fees. Your store is hosted on the iCAT Web site, however, and will look different from your current pages. LinkExchange's solution builds the store on your site, so it may be preferable, but it costs more, with a \$150 setup fee and steeper monthly charges.

In addition, SmartAge offers links to nine affiliate programs, such as Amazon.com's, directly. It also offers more than 65,000 programs through LinkShare (see our table "Affiliate Programs").

SmartAge's free search engine submission service sends only your URL and e-mail address to six engines, such as Excite and Lycos. For \$9.99, however, you can

submit your data to more than 400 search engines and directories. Although SmartAge sends the same basic data to all services, it offers neither WebSite Garage's ability to submit only the data required by specific search engines nor LinkExchange's ability for online customization.

If you're willing to shell out for the extras, then SmartAge will perform other services. For example, for a one-time fee of \$20, its WebSite Code service will use search engine spiders to review your site's text and metatags. For \$6.95 a month, SmartAge monitors your position in seven search engines and makes daily updates.

On the whole, SmartAge's banner program and aggregation of third-party providers is the site's most valuable feature. But its mailing list services, which are essential to building a customer base, fall short.

AFFILIATE PROGRAMS

An easy way to make money from your site is to steer your customers to other Web merchants and collect money from the resulting purchases. The following sites can not only help make you money but also help you promote products related to your site.

	THE DEAL	PROS	CONS	EXTRAS
GENERAL MERCHANDISE				
 www.linkshare.com	From one Web page, members can track activity of multiple affiliate programs. Member sites can evaluate whether to affiliate with your site.	Over 150 online merchants such as Avon, 1-800-Flowers, and many lesser-known sites.	Some merchants may take several weeks to review your site. No estimate is given on how much time the approval process takes.	If you generate significant traffic, member sites may cut you a better deal than the original terms.
 www.refer-it.com	A clearinghouse of information on more than 500 affiliate programs, with descriptions and ratings.	You can browse the various programs and join them from Refer-it. Includes major players like Amazon.com and Reel.com but consists mostly of lesser-known merchants.	Refer-it is basically just a link list, so you can't use it to track your affiliate commissions.	Has a helpful guide for creating your own affiliate program.
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 www.outpost.com	3 percent cash or a 5 percent Outpost credit on software titles. You must sign up through LinkShare.	Part of the LinkShare network, so you can track sales and traffic reports at LinkShare's site.	No commission on leads that generate Outpost.com hardware sales.	Weekly e-mail newsletter with fresh ideas and promotions.

WebSite Garage

www.websitgarage.com

● Sure, WebSite Garage has its shortcomings. It's not nearly as full-featured a service as LinkExchange or SmartAge, because it lacks a banner exchange program and e-commerce features. But WebSite Garage more than compensates by offering several notable and unique features.

For starters, it offers the one tool that your Web site cannot afford to do without: the Hitometer, a traffic analysis tool. WebSite Garage also offers a mailing list program that will make direct e-mail marketers drool and a useful tune-up feature to get your site running on all cylinders.

But the Hitometer is the true gem. This Web-based tool tracks visitors to your site in extraordinary detail. It tells you which Web page or search engine visitors came from to get to your site and, if they used a search engine, which keywords they used to get there. It also tracks how many people visit and when. (LinkExchange and HyperBanner offer only page counts, and no other statistics.) Bet-

ter yet, for a mere \$4.99 a month, you can choose whether to receive these reports daily, weekly, or monthly.

WebSite Post Office, Commercial Version, is WebSite Garage's fee-based mailing list service. It offers two key advantages over LinkExchange's ListBot: It can personalize your e-mails and can track response rates from your messages.

If these features aren't important to you, go with LinkExchange's ListBot Gold mail service because it is cheaper, more feature-rich, and easier to administer. Post Office Commercial costs \$99.99 a year for 12,000 messages, compared with 60,000 messages per year from LinkExchange at the same price.

But LinkExchange accepts messages from your e-mail editor and can send attachments—two key features that Post Office Commercial lacks. Also, LinkExchange automatically deletes the e-mail addresses of bounced-back messages from your list, a manual process with Post Office.

A free version of Post Office collects customer demographics and archives messages but doesn't personalize greet-

ings, import existing lists, or track URL click-throughs.

WebSite Garage's !Register-It!, another free service, provides real value, submitting keywords, short and long site descriptions, and other details to 11 major search engines such as Excite, Infoseek, and Lycos. For \$39.99, you can submit your site to 400 search engines and directories. It also lets you provide custom information for most specialized directories. But WebSite Garage can't monitor search engine position over time, a feature both LinkExchange and SmartAge offer.

Another useful tool is WebSite Tune Up. For \$9.99 per month for 50 pages or \$12.99 per month for 150 pages, Tune Up checks browser compatibility, page load-time, links, spelling, and more. This is money well spent for virtually any site.

LinkExchange offers a more compelling banner exchange program and e-commerce offerings. Still, WebSite Garage is worth checking out for its Hitometer, site tune-up capabilities, and e-mail tracking tools. **PC**

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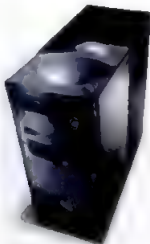
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*Estimated reseller price to end users. Actual prices may vary. Prices do not include monitors. Prices are for the following models: Netfinity 847631U, PC 300 6287-32U, IntelliStation 6893-62U, ThinkPad 390-90U. ¹A product is Year 2000 "Ready" if the product, when used in accordance with the associated documentation, is capable of correctly processing, providing and/or receiving date data within and between the 20th and 21st centuries, provided all other products (for example, software, hardware and firmware) used with the product properly exchange data with it. ²"Ready" refers to the IBM hardware only, not to any software. IBM cannot take responsibility for the readiness of non-IBM software and other products, even if they are preinstalled or otherwise provided by IBM. You should contact these third parties directly to verify readiness, understand limitations, and/or look for updates to their products. If your computer is on at the beginning of the Year 2000, you should turn it off and then back on again once, or restart the operating system, to ensure the internal clock resets itself for the new century. To learn more about IBM PC products and the Year 2000, visit our Web site at www.ibm.com/pc/year2000 or call 1 800 426-3395 and request fax document #10020. ³MHz measures only microprocessor internal clock speed, not application performance. Many factors affect application performance. ⁴GB means one billion bytes when referring to hard drive capacity; accessible capacity may vary. ⁵Variable read rate. Actual playback speed will vary and is often less than the maximum possible. ⁶Fire GL1 is a trademark of Diamond Multimedia Systems, used under license. ⁷For terms and conditions, visit www.ibm.com/pc/us/y_ibm. IBM and IBM product names are trademarks of International Business Machines Corporation. Intel, Intel Inside and Pentium are registered trademarks of Intel Corporation. ©1999 IBM Corp. All rights reserved.

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BUILD it

Great athletes have to take their game to the next level if they want to win the championship. If you want to win on the Internet, you have to take your site to the next level, moving from flat, static pages or minimal interactivity to the kind of capabilities that let you and your customers do business online.

The numbers tell a compelling story. According to International Data Corp.

(IDC), companies will spend over \$200 billion over the Internet in business-to-business transactions by 2002. On the consumer side, Forrester Research estimates that by the end of 1998, 50 percent of all U.S. households owned PCs, with 29 percent routinely going online.

Making the investment to go online and grab some of that business market or attract those consumers can be an arduous process. In this roundup, we look at five development packages designed to help you build your next-generation online applications: Allaire ColdFusion 4.0, Microsoft Visual Studio 6.0 Enterprise Edition, Oracle Developer 6.0, SilverStream 2.5, and Sun NetDynamics 5.0. We consider mainly the needs of small-business owners who want strong, easy-to-use tools without spending hundreds of thousands of dollars.

Keep in mind, however, that these tools collectively address a wide range of approaches to Web development. The tool you select will ultimately depend on many factors, including the complexity of your application requirements, your existing infrastructure and in-house expertise, IT budget, and application hosting decisions.

DIFFERENT ARCHITECTURES

We asked each vendor to help us build a real-world Internet-based application (see "PC Magazine Labs Scorecard"). The results were very different architecturally, because of differ-

ences in the development approach imposed by each tool. With ColdFusion, for example, writing the application is a lot like writing HTML; most of the development is done through server-side scripts in which commands are embedded inside HTML pages. It lets you build applications without hiring a staff of professional Java or C++ programmers.

On the other end of the spectrum, tools like NetDynamics, Oracle, and SilverStream provide more robust environments for server-side Web development, but they require more highly skilled developers and are suited for larger-scale development projects. They give you the power of a full development language (Java) and are better suited for interfacing with existing legacy systems or business objects using COM or CORBA.

Microsoft's tools sit between these two extremes: Its Active Server Pages (ASP) technology allows for Web-server scripting, but developers can also build middle-tier business objects (using Visual Basic, C++, or Java) based on the company's Component Object Model (COM).

DEPLOYING YOUR APPLICATION

The development tool you select also influences the way you deploy your application—and the amount of money you spend. For smaller-scale projects, it may be easiest to have an Internet service provider (ISP) host your application, since many ISPs support one or more of the application development packages we tested. For example, many ISPs are set up to host ASP-based or ColdFusion applications and often charge less than \$50 per month. For larger projects, you need to purchase your own servers and either locate them at a hosting provider or serve the pages

directly from your own site.

For more critical applications where 24-hour, 7-day availability is a necessity, most of the tools reviewed here offer some level of software fail-over or load-balancing capabilities,

BY JOHN GARRIS



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THE DEVELOPMENT TOOLS LANDSCAPE

You have lots of choices when developing Web applications. Here are the major ways you're most likely to start your efforts.

CGI SCRIPTING

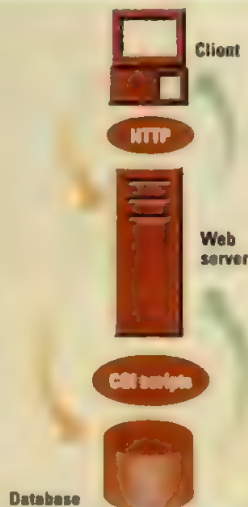
WHAT IT IS: Common Gateway Interface (CGI) lets developers use standard languages such as Perl to write server-side programs that respond to Web requests.

PROS: Easy to implement; does not require knowledge of new programming environment. Inherently cross-platform.

CONS: Not suited for large-scale development projects. Performance limitations.

RECOMMENDED FOR: Development projects with low performance requirements. More applicable in Unix environments where other options such as Allaire ColdFusion and Microsoft Active Server Pages (ASP) are not available without extra cost.

PRODUCTS: Most Web servers, such as Apache, IIS, and Netscape, support CGI extensions.



PAGE-BASED TOOLS

WHAT THEY ARE: Packaged environments such as Allaire ColdFusion or ASP that developers use to build Web pages with embedded functionality. Scripting language is easy to learn and simplifies performing routine functions (database access, security).

PROS: Built-in tools for common functions. Performance optimizations include database connection pooling and cached results retrieval. Scripting language is easier to learn than Java or C++.

CONS: Hybrid HTML/server scripting approach makes it

harder to separate presentation and business logic. Not based on full programming language; functionality is limited or requires interaction with a separate business object layer.

RECOMMENDED FOR: Environments geared for using ColdFusion or ASP out of the box for intranet or small to midsize applications. Page-centric approach is better for content-heavy applications than for apps with complex business rules.

PRODUCTS: Allaire ColdFusion, Microsoft IIS/ASP.

or both. Of the bunch, NetDynamics offers the best set of deployment tools; it provides granular options for deploying modules across multiple servers and comes with performance-tuning tools. Most of the tools reviewed here have automated mechanisms for pooling database connections and caching results for improved performance.

THE FINAL ANALYSIS

The most important thing you can do when picking your development package is to select one consistent with your approach to application development. Individual features and capabilities are important, but make sure the tool you pick is powerful enough for your needs and gives you the ability to scale as you grow, all without giving you too much at too high a cost.

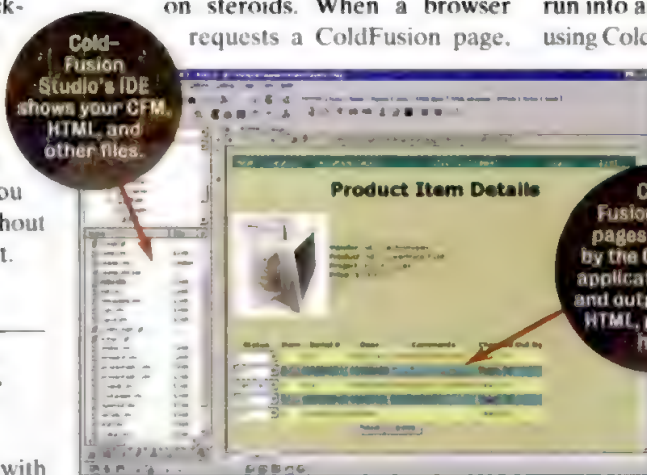
is a powerful, sophisticated, and extensible environment (you can extend applications using server-side code). In fact, developers will find that with ColdFusion, moving from building Web sites to Web applications is a natural evolution.

Architecturally, ColdFusion works very much like Microsoft's Active Server Pages (ASP). You write HTML pages marked up with special tags and logic in ColdFusion Markup Language (CFML), a proprietary language that's like HTML on steroids. When a browser requests a ColdFusion page,

which typically has a CFM extension, the ColdFusion server parses the page and turns CFML into HTML.

ColdFusion does have one edge over ASP, though: its similarity to HTML. Scan an ASP script and you might think that a foreign language has infected a Web page; but CFML code usually resembles HTML because it, too, is tag-based—although CFML, with its tag-based system, lacks the flexibility of a full programming language like Java. During testing, though, we didn't run into any task we couldn't accomplish using ColdFusion.

Like Microsoft Visual Studio, ColdFusion allows you to divide different types of development projects among developers. For example, those working on middle-tier applications in ColdFusion can work either in CFML or in C++, but the results appear as custom tags. Presentation developers can then use the



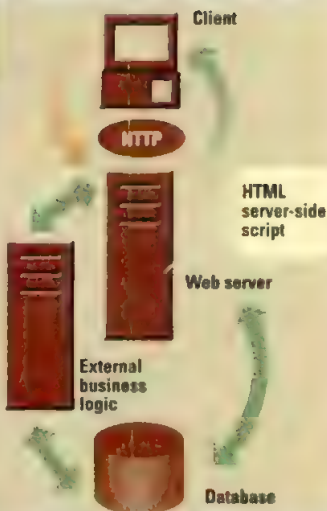
Allaire ColdFusion 4.0

ColdFusion Studio, \$395; Server 4.0 Professional for Windows, \$1,295; Server 4.0 Enterprise for Windows, \$3,495. Allaire Corp., Cambridge, MA; 617-761-2000; www.allaire.com.



Web developers charged with building interactive, dynamic Web applications will find a lot to like in Allaire ColdFusion 4.0. Designed from the ground up as a Web application platform, ColdFusion

Our Contributors: JOHN GARRIS and LARRY SELTZER are frequent contributors to *PC Magazine*. RICHARD V. DRAGAN is a programmer at PC Magazine Labs and a frequent contributor. GARY GUNNERSON is an IT architect at Gannett Corp. JAY MUNRO was the project leader, and DAVID LIDSKY was the associate editor in charge of this story.



APPLICATION SERVERS

WHAT THEY ARE: Development environments, such as Sun NetDynamics, for building programs that handle all application operations between a browser and a company's back-end applications or databases. Along with features to simplify database access and security administration, they offer built-in load balancing and fail-over functions at the application layer.

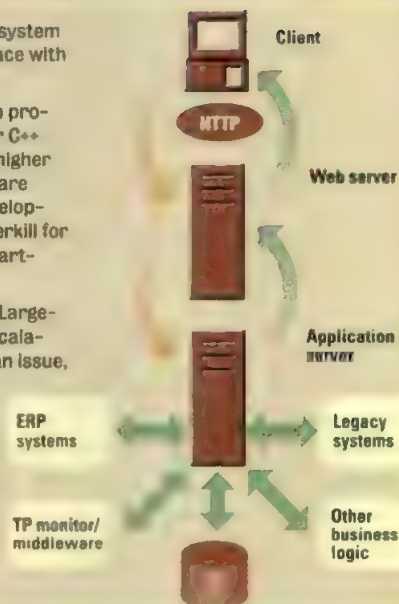
PROS: Built-in class libraries simplify routine application issues such as security. Deployment features simplify session management and system availability issues. Use of HTML templates makes it easier for design teams to

work independently of system developers. Can interface with existing systems.

CONS: More difficult to program (requires Java or C++ knowledge). Generally higher software costs, hardware requirements, and development costs. May be overkill for a small intranet of departmental applications.

RECOMMENDED FOR: Large-scale projects where scalability/performance is an issue, or where complex applications need to be developed quickly.

PRODUCTS: IBM Websphere, Netscape Application Server (Kiva), SilverStream, Sun NetDynamics.



custom tags as they would any other.

ColdFusion Studio, the integrated development environment, is built around Allaire's HomeSite Web page builder and shares all of its strengths. The multipaned environment has a complex but typical RAD tool set up. You'll find button bars at the top, including a section for all the CFML tags.

The main editing window lets you switch between direct editing of code, a live browser view of the page (using the Internet Explorer browser object), and a visual design view that lets you graphically design and modify the page. It's a complicated and dense environment, but everything you need is within easy reach.

In the code editor, the advantages of HomeSite shine through. If you're unsure of a tag's syntax, you can easily bring up a dialog box to fill in the values for the tag, and HomeSite writes the syntax for you. In many cases, such as building tables, you can go to the visual designer and draw the feature out visually. Then skip back to the code editor and you'll find that the skeleton code, with all those table tags, is built for you. The visual designer is updated automatically if you hand-edit code.

And the IDE's debugging facilities are excellent. The debugger integrates well with ColdFusion's database access, letting you watch record sets. This is particularly helpful for fixing incorrect output on Web

pages that are updating fields in a database, since the debugger shows whether the problem is in the database or the logic.

In ColdFusion, connecting to your database is easy. For example, the common <CFQUERY> tag tells the ColdFusion engine to issue a database query

and return a record set. You then run a <CFOUTPUT> tag specifying that query and put database field names in HTML; ColdFusion then automatically substitutes the actual query results in HTML returned to the browser.

The ColdFusion server can be admin-

EDITORS' CHOICE

Allaire ColdFusion 4.0



If putting up your first informational site on the Web is like dipping your toe in the Web pool, building a Web application is diving in head first. We award

Allaire ColdFusion our Editors' Choice because it's the best tool for ratcheting up your Web interactivity without requiring deep pockets or a great deal of time and effort to learn.

ColdFusion Studio is an excellent integrated development environment. It uses Allaire's own tag-based CFML to build applications, giving Web page designers accustomed to HTML coding a natural progression when learning to build Web applications. It's also affordably priced at \$395. Even better, many ISPs support the ColdFusion

Application Server, making it easy and affordable to host your application. The product also has strong administration tools, making remote site management painless, and built-in clustering support, giving you scalability.

Sun NetDynamics 5.0 merits an honorable mention for its enterprise-strength power in building high-end Web applications. We were particularly impressed with its ability to import data and objects from almost any environment and add them to your application. But for small- to medium-size businesses, Sun NetDynamics 5.0 is overkill.

istered via the Web with a special ColdFusion application, and the security model lets you restrict administrative capabilities and access to specific files, databases, CFML tags, users, and groups. You can also delegate certain administration tasks, making it easy for ISPs to let customers run and administer ColdFusion on their sites. Such users run Administrator but have access only to the tools they need for building and administering their applications. As a result, there are approximately 400 ISPs that support ColdFusion development, a significant reason to prefer it to other products in this roundup, such as SilverStream and Oracle, if you're not big enough to afford your own infrastructure.

When your ColdFusion site becomes a mission-critical part of your enterprise, you can use the built-in clustering support, a version of BrightTiger ClusterCATS (www.brighttiger.com). The clustering provides for *server fail-over*, which lets one server take over requests to a failed server, and allows even distribution of load among multiple ColdFusion servers.

ColdFusion is built for the Web and is a tried-and-true solution on large commercial sites such as Autobytel.com, showing its scalability. The development environment is powerful, and the product has extensive third-party and ISP support. Developers will find this a firm foundation for Web applications.—Larry Seltzer

Microsoft Visual Studio 6.0 Enterprise Edition

\$1,619; upgrade, \$1,079. Microsoft Corp., Redmond, WA; 800-621-7930; <http://msdn.microsoft.com/vstudio/>.

● Making great strides from its previous incarnations, Microsoft Visual Studio 6.0 Enterprise Edition offers lots of options and programming muscle to create Web applications. It requires object-oriented developer expertise, however, and—to push the product to its full potential—loyalty to the Microsoft server platform. These limitations put Visual Studio somewhere between Allaire ColdFusion's ease of use and Sun NetDynamics' unbridled deployment flexibility.

Microsoft's Distributed interNet Application (DNA) Architecture forms the crux of its Web platform strategy. Microsoft offers two ways to create these



To determine the best tool for creating Web-based applications, we did hands-on testing of midlevel data-based rapid applications development (RAD) tools. To do this, we sent each vendor a program specification for building a product catalog database application that could either track inventory on a private intranet or run on the public Web as an e-commerce catalog.

Before coming to PC Magazine Labs, each vendor created the base catalog and inventory portion of the application. Once in the labs, representatives of each vendor were teamed with a reviewer, who deployed the application on our Internet/intranet test bench and ensured that it met the program specifications.

We then presented each vendor/reviewer team with a second specification, which outlined new features and capabilities to be added to the inventory

program: images of the products, new columns in the product tables for prices and images, and secure access for viewing and purchasing products.

Each such team then used the product's data tools, interface builders, and code editors to finish constructing the application. On its completion, we hosted the application and associated software on our application server and Web server, then tested the result for functionality.

The test-bed consisted of two Pentium II/400-based Dell Dimension XPS R400 servers, each with 128MB of RAM, running Windows NT Server 4.0 with Service Pack 4, on a 10MB Ethernet network running TCP/IP. On the client side, we used 266-MHz Micron Millennia PCs, each with 64MB of RAM, running Windows 98 and Windows NT Workstation with Service Pack 4. Each vendor chose whether to use our installation of Microsoft IIS 4.0 and Microsoft SQL Server 7.0 Enterprise or its own Web server and database software.—Jay Munro

	EDITOR'S CHOICE				
	Allaire ColdFusion 4.0	Microsoft Visual Studio Enterprise Edition 6.0	Oracle Developer 6.0	SilverStream 2.5	Sun NetDynamics 5.0
POWER					
Interface development	Excellent	Good	Good	Good	Good
Database connectivity	Good	Excellent	Excellent	Good	Excellent
Application logic	Fair	Excellent	Excellent	Excellent	Excellent
Deployment	Excellent	Good	Fair	Good	Excellent
EASE					
Interface development	Excellent	Good	Good	Good	Good
Database connectivity	Excellent	Good	Good	Excellent	Good
Application logic	Excellent	Good	Good	Good	Good
Deployment	Excellent	Excellent	Good	Good	Excellent

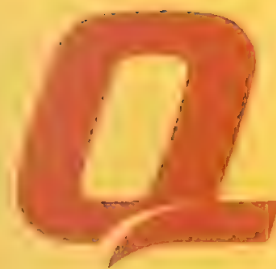
DNA applications. The new Visual InterDev 6.0 (VI) is a fully functional RAD Web development environment that makes use of Active Server Pages (ASP) for delivering Web content on the fly. The alternative method (which Microsoft recommends for optimal scalability and ease of maintenance) is to take advantage of Visual Basic 6.0 (VB) to build middle-tier business objects and use VI merely for client-side presentation.

The recommended method comes with a certain price in that you need to perform some object design with VB (or Visual C++)—not a skill every shop possesses. If you absolutely need the benefits of the middle tier but have little or no object

design experience, a tool like Oracle Developer 6.0 might be a better choice.

The good news is that once you create these objects, anyone on your team can use them. On our tests, we had no problem creating new product screens—and tweaking old ones—in VI using objects created with VB.

An advantage of the Microsoft Web platform is the built-in support for transaction processing through Microsoft Transaction Server (MTS). While Oracle supports database transactions, it doesn't offer transaction monitoring, as Microsoft does. But MTS pools objects for potentially greater scalability and reliability for busy e-commerce Web sites,



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PREVIEW: IBM WEBSPHERE STUDIO 3

Watch any sporting event on TV and you won't be able to miss those attention-grabbing IBM eBusiness ads. A key aspect of IBM eBusiness is its WebSphere product. WebSphere Studio 3.0, IBM's newest version of its Java-centric IDE optimized for WebSphere servers, was not ready in time for testing, but we did get a look at the beta. Studio 3 is a great way to get started with a Java IDE and can easily grow into an enterprise team development workbench. It should be shipping in late June or July.

WHAT'S IN THE BOX

Studio 3 builds upon what Version 1.0 of the software included (IBM skipped Version 2). Version 1.0 consists of the workbench that helps organize Web projects around a common user interface: the NetObjects tools

ScriptBuilder for creating

HTML and Java server pages.

Fusion for interface development,

BeanBuilder (formerly Lotus Bean

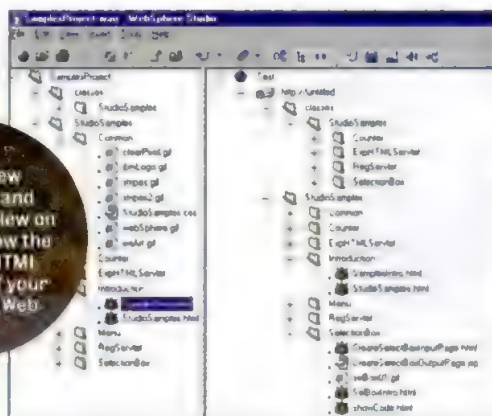
Machine) for building Java Beans; and IBM's

VisualAge for Java, Professional Edition Version 2, a complete Java development tool.

Studio 3 notably folds in the Wallop Build-IT technology, which adds some very desirable usability features for creating and maintaining your Web application. It includes an integrated HTML and Java Server Page (JSP) editor, site templates, and the ability to drag and drop JavaBeans and database queries.

For maintenance, you'll find JSP debugging; database insert, update, and delete logic; JavaScript validation and formatting; link checking and repairing; and direct connections to industry-standard source control packages. Studio 3 also includes a copy of the Apache Web server for immediate testing.

The Object view on the left and Publication view on the right show the complete HTML structure of your developing Web site.



BUILDING YOUR SITE

When using Studio 3 to design a Web site, your entry point for the product is a Windows Explorer-style interface (see the screen). The second pane shows either a publishing view where your HTML structure appears on the screen or a relationship view that provides very helpful path pointers from documents to the selected page and pointers to resources used on the current page or a code view.

One nice feature of Studio 3 is that it lets you import an existing HTML Web site and start adding in data-driven Java server pages. Invoking the JavaBean wizard walks you through the database connection, selection, and presentation

through the WebSphere server. One feature severely lacking, though, is the ability to simplify the presentation of a multipage query set with automatic navigation. NetDynamics, among other tools, makes this easy, but Studio 3 makes you code this yourself. (IBM Corp., White Plains, NY; 800-426-4968; www.ibm.com.)

PUBLISHING WITH WEBSPHERE

In order to publish your IBM WebSphere Studio 3 application, you will need to purchase a license to one of the three WebSphere server products.

Standard edition provides database connections

with a JavaServlet engine. Advanced edition adds in Enterprise JavaBean and host connectivity support, while Enterprise edition adds IBM's component broker and transaction services. For a dynamic enterprise class deployment, you will also need the WebSphere Performance Pack, which adds caching, server/data mirroring, dynamic load balancing, and a virtual file store.

You can find the beta software available for immediate download at www.software.ibm.com/webservers/studio/index.html. Studio 3 will cost \$495 when it ships. In one compelling package, WebSphere Studio 3 provides everything you need to get started creating Java-centric, database-driven Web sites. (IBM Corp., White Plains, NY; 800-426-4968; www.ibm.com)—Gary Gunnerson

which ASP alone won't provide.

Using VI to create ASPs is much easier than it once was. Version 1.x of VI demanded a lot of do-it-yourself coding, but the new version is a much improved, RAD-style tool. With its auto-complete, IntelliSense technology, we could select methods for each object on the fly rather than having to type a lot of code.

VI's generous set of wizards for such common tasks as creating database forms and default pages helped get us started. While we still needed to view and write HTML and script code, more often we were able to drop components onto a design and attach VBScript code for event handling instead of writing a lot of custom code from scratch.

One of the strengths and surprises of

the Microsoft model is the ability to defer the choice of a deployment style—either HTML for the widest reach or DHMTL (for IE-specific deployment). This is accomplished through VI's design-time components (DTC), a set of object-based events and methods that can help you build your Web application's user interface rapidly.

Visual Studio is the only package reviewed here that exposes the middle tier easily for developers. Oracle, on the other hand, hides the middle tier but provides great default scalability. During testing, we needed several extra hours of work to build a library of objects using VB and deploy them to the middle tier for our prototype application. On the plus side, though, VB handles all the details of

deploying and registering COM objects on the server.

In testing, the product catalog system we built with Visual Studio was full-featured and responsive. It had no problems running in both Netscape and Microsoft browsers. Its interface took advantage of HTML tables and offered all of the functionality of its client-server counterpart.

This client-side flexibility, however, is not matched on the server side, which generally requires you to use IIS with related Back Office tools (such as MTS) to get the most out of Visual Studio. Many ISPs support ASPs, but to follow Microsoft's recommended method of creating a middle tier, you will need MTS to take full advantage of this platform—and that probably means running your own hardware.

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Visual Studio also offers the best debugging environment of any program in our roundup. You debug the entire Web site—ASPs, VB middle-tier objects, and even stored procedures on SQL Server or Oracle code. ColdFusion, by contrast, has excellent debugging capabilities, but it debugs only ColdFusion

The separate JVM lets the same code run unrestricted inside either Netscape Communicator or Microsoft Internet Explorer. It also lets you manage security, which normally prevents printing and local file access in the Java sandbox. At 8MB, however, the JVM is too large for applications that you want widely deployed to the public across the Internet.

Although Oracle chose to premiere its new version of Oracle Developer 6.0 for this review, for truly industrial-strength, model-based development, Oracle Enterprise Developer Suite 6.0 (\$9,995 per developer, due out around the time you read this) will add significant flexibility for Web development.

The previous version of this package, Oracle Web Developer Suite, won our Editors' Choice last year. In addition to Developer 6.0 and Developer Server 6.0 (reviewed here), Enterprise Developer Suite ships with Oracle Designer 6.0, a powerful modeling tool, as well as Oracle Application Server 4.0, and Oracle8 and Oracle8i for the database back end.

The mantra for Oracle Designer 6.0 is the ability to "get from pictures to code and back again." Oracle Designer offers a model-based approach that lets you design applications without coding and with greater flexibility for the Internet, since your Web applications can be

deployed in HTML instead of Java (using Application Server) if you need to reach the public Internet. You can deploy to all of these targets from the same modeling diagrams.

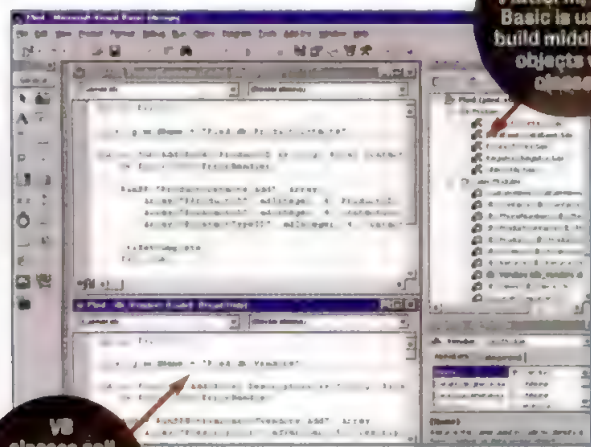
Without Designer, you use the Form Builder (called Oracle Forms in earlier releases) to create designs for your applications. It's a RAD-style fourth-generation language (4GL) tool that lets you use Oracle's proprietary PL/SQL language to create the logic behind your product catalog design instead of writing Java code directly.

The Form Builder includes several excellent wizards to get you started, including the Layout Wizard for generating a default form against a database query, and the new Syntax Wizard that lets you paste arguments for PL/SQL into your code. We like the Syntax Wizard, but it's a step behind IntelliSense in Microsoft Visual Studio 6.0 Enterprise Edition. Another wizard, the List of Values (LOV) wizard, makes it easy to generate a pop-up list of values based on values in the database. It's not as slick as Sun NetDynamics' wizard, which can populate list boxes, tables, text lists, or data objects, but it's a welcome ease-of-use feature in an area where Oracle has traditionally been deficient.

That said, Oracle Developer 6.0's ease of use still lagged behind that of Allaire ColdFusion 4.0 and Visual Studio. For example, you'll find fewer components (only about a dozen and a half) to work with. Though you can extend the component set with custom Java-

Beans, you'll need Oracle JDeveloper (a separate product) to create Java-Bean components.

A key advantage to using Developer is that once you download the custom VM, the actual Java code is very thin because everything happens on the server. You can think of this as a smart Java terminal, which downloads Java components selectively at runtime, and all the middle-tier processing is available for your Developer application without any



VB classes call stored procedures from database back ends.

scripts; it will not take you into the database code itself.

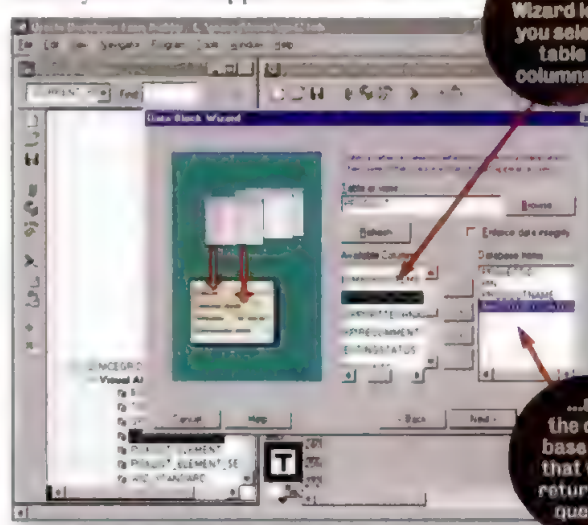
On the whole, Visual Studio provides a rich Web development environment for creating scalable applications. It requires some developer expertise to use effectively and virtually requires Windows NT on the back end, but this version of Visual Studio shows the maturation of Microsoft's Web platform.—Richard V. Dragan

Oracle Developer 6.0

Developer pack, \$5,995; client licenses, \$195 per concurrent device. Oracle Corp., Redwood Shores, CA; 800-672-2531; www.oracle.com.

● Best suited for intranet development, Oracle Developer 6.0 features improved ease of use and a number of new features that will make it an appealing upgrade for existing Oracle programmers. For creating public Web applications, however, you should consider another product or wait for the forthcoming Oracle Enterprise Development Suite 6.0, which is better suited to creating them.

Understanding the role of Java in Oracle Developer 6.0 is key to understanding the product. Oracle provides its own Java Virtual Machine (JVM) called JInitiator, an 8MB plug-in that your users must download before running Developer applications.



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additional work. You never think about the middle tier—Developer writes all the code that runs on the application and database servers for you. NetDynamics and Visual Studio require developer expertise to take advantage of the middle tier effectively.

Once you compile your Oracle application into Java, deploying and running it using Oracle Developer Server 6.0 is a simple matter. Developer Server does much of the work of scalability, including optimizing database and network traffic for you. All server-side code—from stored procedures, triggers, and even exception handling—is written for you.

For shops without previous PL/SQL expertise, there is little compelling reason to turn to Developer in this release. Version 6.0 improves the ease of use, but PL/SQL development arguably is still a more specialized skill than working with the HTML extensions of ColdFusion, the Java in SilverStream, or the VB and ASPs in Microsoft. All in all, the new Developer is an essential and important upgrade for existing Oracle users.—RVD

SilverStream 2.5

Single developer pack, \$500; unlimited users (one CPU), \$10,000. SilverStream Software Inc., Burlington, MA; 781-238-5400; www.silverstream.com.

● Powered by a flexible approach that lets you create Java applications and deliver them to your users in either Java or HTML, SilverStream 2.5 takes an approach to Web development that makes it useable in either an Internet or an intranet setting. But producing applications with SilverStream requires more developer expertise. You also have to commit to purchasing and maintaining the hardware that hosts your SilverStream applications, since few ISPs support SilverStream compared with Allaire ColdFusion or ASP.

The Java programs you create in SilverStream can run either as applets or as Java applications in the Microsoft Java VM outside the browser. But it's best to deploy the programs as applications

because this avoids the refresh, state, and interface problems that plague applets. SilverStream's Java applications do require downloading a special 90K loader, Jranner, which is reasonable overhead compared with Oracle Developer 6.0's large 8MB Java loader.

Although the loader and the applications aren't especially large, Java still isn't a great way to deploy applications on the Internet. Alternatively, SilverStream does let you create applications that run as server-side Java, in the form of Java servlets, and serve HTML to the clients. This flexibility gives SilverStream some distinct advantages over Oracle Developer, although not over

and the client-side Java code behind them.

Views is for creating special objects for browsing data sets. These objects are then used in Forms and Pages. *Media* is a collection space for images, sounds, JAR files containing third-party Java code, and other miscellaneous elements that you may need to refer to in your program. *Objects* stores server-side business logic.

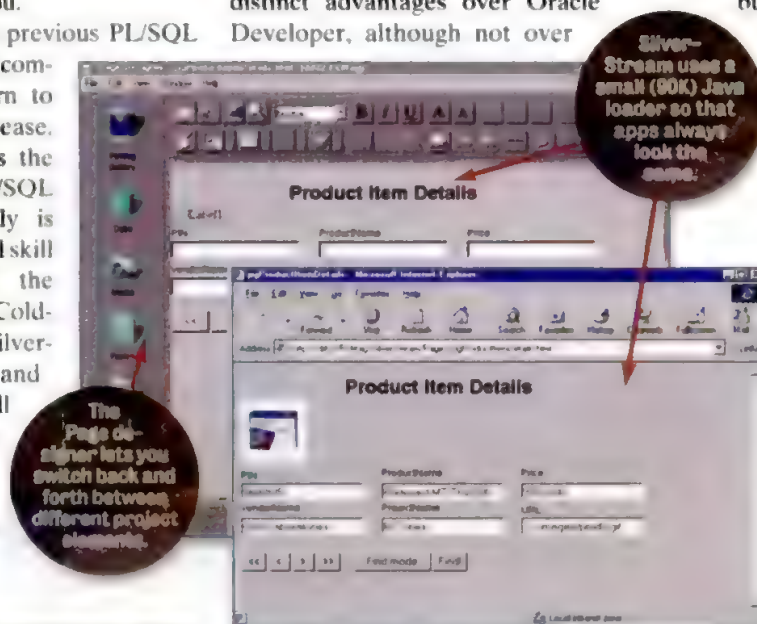
Last, *Pages* is the section where you design HTML applications or, more specifically, the servlets that generate them. It works much like a typical RAD environment: You write Java code to define various events (such as what occurs when a button is clicked or when a row in a list view is selected) on the pages you build. The ability to write this code in Java makes SilverStream more flexible but also steepens the learning curve.

Still, you can get quite far using both the Page and the Forms designer without writing Java code—or at least not a lot of it. SilverStream lets you design the full user interface and customize it a great deal just by manipulating object properties in their dialog boxes. Also, we created views of our product catalog programmatically on the fly instead of using the static view designer. Because of our application requirements, this more sophisticated technique meant less work and a faster program.

Debugging is not done well in SilverStream, another factor that makes the product more difficult to use than some of its competitors. Without a debugging system for server-side Java, you must resort to the old-fashioned (but effective) technique of writing messages to the console. SilverStream has a debugging facility for client-side Java, but it was slow in our testing.

The SilverStream server is a complex story unto itself. It's a Web server; it supports a variety of database servers and security authentication methods including those used by Windows NT and LDAP; and it even supports clustering. You manage all this the same way you manage application building: by using simple property sheets.

In general, ease of use isn't the product's strong suit, however, and Silver-



the whole Oracle Enterprise Development Suite or Sun NetDynamics 5.0.

Among the most organized of the systems in this roundup, SilverStream stores all application elements—such as servlets, Java client source code, images for the HTML pages, and server-side business logic—in a database. This not only simplifies the management of large, complex applications but eases backup, too: When you back up the database, you back up the entire application.

The SilverStream development system is made up of six sections: Tables, Forms, Views, Media, Objects, and Pages. *Tables* stores the SilverStream metadata referring to the actual database data. You can use these tools for minor data design, but they aren't meant to replace full-blown database design tools. Java client programs are written in *Forms*, with both the user interface

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Stream isn't for everyone. Java coding is beyond the skill set of most Web designers, although Java skills are becoming more common. You're also more likely to be interested in SilverStream for intranet-type applications, such as HR systems, because of the Java client and because few ISPs support SilverStream. But if you choose SilverStream, you'll find a Web application system with the flexibility to do what you need to do.—LS

Sun NetDynamics 5.0

Studio, \$895; application server, \$25,000 per CPU. Sun Microsystems Inc., Palo Alto, CA; 800-786-7638; www.netdynamics.com.

● Think of Sun and you might think only of Java. But while Sun NetDynamics 5.0, Sun's Web application server, provides a complete Java delivery environment, it goes well beyond that to bring you an incomparable array of data and objects that greatly extend your freedom in creating applications. But this incredible power is designed primarily for high-end Web applications (portal computing, to use Sun's term), and it's more than most companies need.

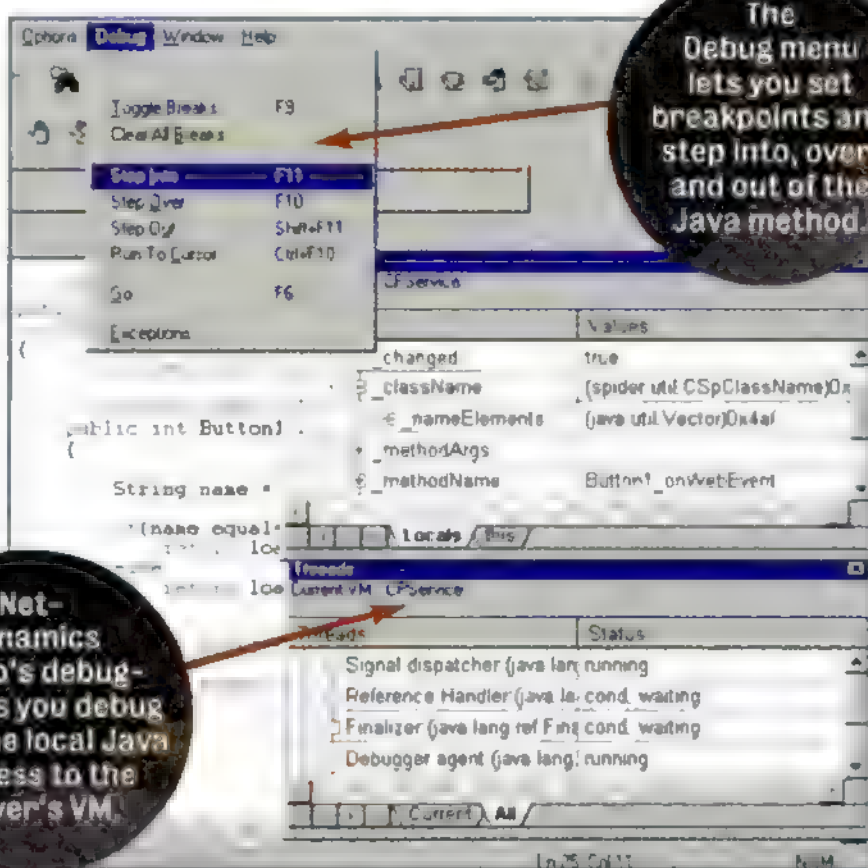
Sun recently acquired Netscape (Kiva) Application Server through its alliance with AOL and has promised to merge the code bases of Netscape and NetDynamics for an integrated offering in 2000. Sun has pledged to make the new version backward-compatible and will support any purchases made today. No one can say how much of NetDynamics will survive in the combined offering, but the NetDynamics development tools, which we focus on, are much stronger than anything that Netscape has to offer.

Five products make up the NetDynamics application server platform. The application server itself runs on a Java Virtual Machine that provides the deployment engine for the suite. The Command Center console serves as the window into the single machine or distributed cluster serving the application code. Studio is the integrated development environment (IDE). A JavaBean editor lets you finely tune your Java code for a more pleasing display. And the Platform Adapter Component (PAC) manager provides access as product add-

ons to object stores and data objects of almost every flavor, including Microsoft's component object model (COM), as well as AS/400, CICS, CORBA, PeopleSoft, SAP R/3, and XML, and makes them available to the IDE. No other platform offers this kind of flexibility.

You start a new project in Studio. The IDE lets you connect to services and create data objects or views into existing data stores; then you can create pages using HTML, Java, or a combination to render each page. The properties you select when using wizards, or within each page, control actions to databases and page-to-page navigation. During testing, by using the page wizards for our product catalog application, we easily created a relationship between a summary and detail page containing links and navigation buttons.

When you create a data object, Studio's wizards look at connected data stores and offer browsing windows to select data sources and then data fields.



The application server uses JDBC (preferring type 4 drivers) to perform database actions. Since there is no need to load separate drivers for each database type, this makes it easier to add data sources.

Studio lets you create multipart pages; it has two ways of doing so. You can either start with separate subpages and combine them on a final page or start with a primary key page and manually add in selected fields. You can then render any page or subpage as either HTML or Java. In our testing, the subpage concept saved a lot of work.

When you place a Java object on a

page, you can then access existing Enterprise JavaBeans (EJBs). Studio looks into the Bean and exposes the internal functions within the environment. This makes selecting specific business logic quite easy. Studio also offers the ability to create your own Beans using standard Java coding.

Another excellent feature is the full-featured Java debugger that lets you step through Java application code from the applet to the server and even down to the virtual machine. SilverStream's Java debugging is rudimentary by comparison.

NetDynamics' page code prior to compilation includes tags that look like simple text fields surrounded by double asterisks. This makes editing within a text editor quite simple but can cause editing errors if your visual HTML editor does not have a method for understanding the tags. These errors can cause the design elements on the left side of the editing frame to get out of sync with the actual tags prior to compilation.

Another area where Studio falls a bit short is its support of visual page elements treated as templates or style sheets. You have only a single HTML template per project, leaving you to code manually for more extensive page layouts. One workaround is rendering each of your site sections as a separate project.

All the benefits of easy code assembly and enterprise data action would be for naught if the deployment engine fell short of full 24-hour, 7-day, ISP-class performance. The application server and Command Console offer some of the most extensive mechanisms for load balancing, automatic fail-over, caching, pooling, thread management, and SNMP reporting. The app server peeks into the inner workings of your applications and into the Java Virtual Machine; it provides many manual tuning options. In addition, the distributed transaction support using Java Transaction Service (JTS) allows multiple commit routines to ensure data integrity across multiple databases.

NetDynamics offers a strong RAD tool, enterprise information integration, and fully scalable deployment to let you build almost any kind of Web application imaginable.—GG 

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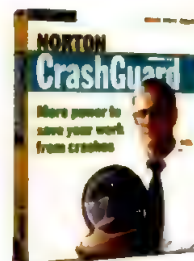
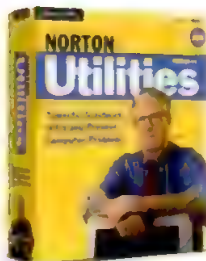
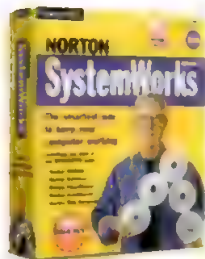
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—Windows Magazine, May 1999

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SERVE it

Few business decisions you make are as strategic as choosing which platform will run your Web site. It can be the crucial factor in determining how reliable and responsive your site is to customers and how much work you have to do to keep it running. With the right products and a good design, your Web site can become a new and more convenient way for customers and partners to work with you. But having the wrong site is like a real-world store having inadequate parking—you risk turning people away and making them unlikely to return.

For this story, *PC Magazine* examined the leading operating systems and Web server products that are running the Internet today. We used leading-edge server hardware from Compaq Corp. and Sun Microsystems to evaluate Linux, Microsoft Windows NT Server 4, and Sun's Solaris 2.6 and 7, running four leading Web servers: Microsoft Internet Information Server 4 (IIS), Netscape Enterprise Server 3.61, Sun's Web Server 2.1, and Stronghold Web Server 2.4.1 (a popular variant of the Apache Web server with secure Web site features added).

We tested these platforms using a new version of Ziff-Davis Benchmark Operation's WebBench, which tests Secure Sockets Layer (SSL) connections of the type found on modern commerce sites. Our tests measure the overhead of secure communication over the Web between you and your customers. "Secure communication" can refer not only to taking credit card numbers and personal data over the Web but also to any type of business-to-business exchange over the Internet. In all such cases, secure communications are imperative, and SSL significantly increases the processing load on your server.

DECISIONS, DECISIONS

Selecting which Web platform is best has a lot to do with answers only you can provide. For example, if your server

administrators are most experienced using Unix, that may be the best reason to run your Web site on it. On the other hand, if you have existing business logic, such as pricing strategies, written in Visual Basic, you may find Windows-based servers most productive. In addition to platform issues, issues of reliability (clustering and load balancing), development environments, content management, and security also have an impact on your decision.

Although in-house expertise and legacy systems are key factors, in many cases a mixed environment is acceptable;

often it is the norm. Even if all your corporate networks are based on Microsoft Windows NT or Novell's NetWare, you can run a Unix-based Web infrastructure. You can use standards such as The Object Management Group's Common Object Request Broker Architecture (CORBA) to let different systems—such as Web servers and databases—communicate. You can even mix Unix and Windows Web servers.

In fact, when you consider what's powering Web sites today, you'll see that heterogeneous networks are quite common. According to Netcraft's much-publicized monthly survey of the servers running the Internet (www.netcraft.com), almost 55 percent of all Web sites are running variants of the Apache server.

Though Apache is obviously in wide use, this statistic overstates its popularity. Why? Because it measures Apache's market share based on the number of unique domain names, as opposed to the number of unique servers.

Apache, popular among ISPs because of its price (free) and unlimited configurability, can host hundreds or thousands of domains on a single server.

Netcraft also surveys SSL servers on the Internet, and there the numbers are very different: Microsoft's 37 percent is almost twice that of Netscape's or Stronghold's share, and Sun Web Server doesn't even make the list. Because SSL servers are more likely to be real business servers (as opposed to those hosting "Great Doghouses of the South" or other home-

BY LARRY SELTZER



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page marginalia), Netcraft's survey is a telling indicator of Microsoft's presence in the market.

HOSTS WITH THE MOST

If you want to farm out your Web site to a hosting service, you still have important platform decisions to make. Just because you aren't running the servers doesn't necessarily mean you won't write all the code on them or be responsible for some administrative chores.

To integrate your Web presence with your business, the hosted servers will have to communicate back over secure lines to your in-house systems to get, say, accurate inventory and customer information. Most large hosting services support both Unix and Windows NT servers, and you may even have a choice of Unix flavors.

Even though there has been substantial consolidation in the Internet software business, you still have lots of choices. After Netscape and Sun eventually consolidate their server offerings, there will be at least three major Web server platforms from large organizations with extensive options. This isn't the end of the Internet software business; it's the end of the beginning.

Solaris

● Sun's claim that it built the backbone of the Internet is not that far from the truth. Look at the Web sites of the Internet establishment, from Netscape to the W3C (World Wide Web Consortium) itself, and you'll find a who's who of Solaris users. Corporate America, including AT&T, General Electric, General Motors, and PepsiCo, also trusts its Web sites to Solaris.

Solaris is a modern operating system. Notably, it supports 64-bit applications (ahead of its time) and includes proprietary extensions that give it a leg up on serving the heavy user loads found on high-traffic Web sites. Solaris also has considerable third-party support for server applications and development tools.

MULTITHREADING

The key to understanding the differences among the Linux, Microsoft, and Sun platforms lies in the way that server pro-

EDITORS' CHOICE

Microsoft Windows NT Server



A few years ago, the race for operating-system dominance on the Internet was wide open. Many Unix vendors had viable products, and Microsoft was no-

where to be found. Well, no more. Because of its speed, ease of setup and administration, and a dizzying array of add-on and development products from Microsoft and third parties, we award Microsoft's Web platform—Internet Information Server (IIS) running atop Windows NT—our Editors' Choice.

Windows NT and Microsoft's Internet server products excelled on our WebBench tests, besting all on our dynamic tests by a wide margin as client usage increased. This illustrates IIS's ability to handle the high-volume traffic experienced by the sites that are using it today, such as Dell and eBay.

Microsoft offers solutions for every aspect of the Web platform, from dynamic page development to transaction processing and message queuing. But you don't need to buy into the complete Microsoft solution to get the benefits of its Web platform.

With hundreds of third-party products plugging into IIS, you could theoretically replace Windows components at almost any level. For example, you could bypass COM for some purposes and implement a third-party CORBA broker to talk to external systems. This versatility lets you opt for Windows NT as your Web platform without locking you into a Microsoft-only solution.

grams on each handle high numbers of user connections—usually through multithreading. Multithreading happens when an application (also known as a process) contains many small units of execution code that run independently and perhaps simultaneously on different processors. These threads can share resources and are a way for a program to organize itself so it can perform more than one task at a time.

The Solaris threading model is quite complex. It consists of kernel-level threads (*kthreads*), which are the actual objects dispatched to an individual processor; user-level threads; and a bridge structure called a *lightweight process*. These allow a fine level of control over the structure of the application and how it is multitasked.

Sun's own Web server and Netscape Enterprise Server 3.61 are multithreaded. Netscape 3.61 adds a new multiprocessing capability that allocates multiple processes associated with kernel threads to improve performance.

STRONGHOLD ON SOLARIS

The creators of Stronghold Web server (and Apache, on which Stronghold is based) belong to the school of thought that contends multithreaded code is generally less reliable than nonthreaded code. The Stronghold authors also say that Web server scalability is usually better enhanced with more memory or servers than by multithreading.

This difference in strategies explains our performance numbers to a great extent, as Sun Web Server 2.1 and Netscape Enterprise both take better advantage of the second processor in our test systems. Although Sun sells Solaris servers with up to 64 processors, and Solaris scales effectively on them, Apache does not use such hardware effectively, depending on the specifics of the application. (For more about Stronghold, see our review of Linux.)

NETSCAPE ON SOLARIS

Netscape Enterprise Server 3.61 is the Web server of choice for the majority of large Solaris sites, including Sun's. Netscape's tools, as well as those avail-

Our Contributors: LARRY SELTZER is a frequent contributor to *PC Magazine*. KASEY LEE is a developer at ZD Benchmark Operation. KEVIN YOUNG was the project leader, and DAVID LIDSKY was the associate editor in charge of this story.

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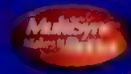
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SUN'S WEB PLATFORM

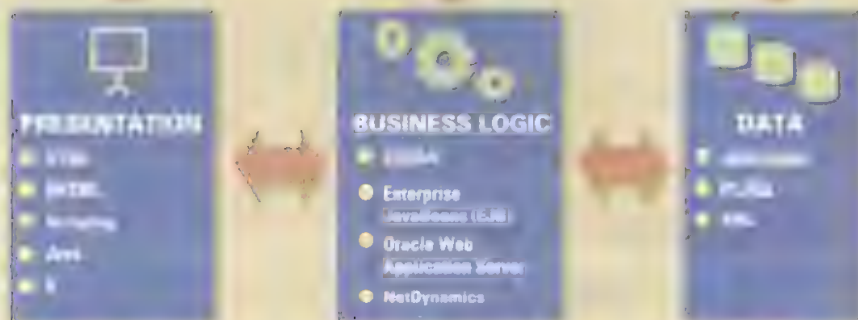
Solaris ships with a rich set of basic services in various configurations for different tasks such as enterprise and ISP usage. Sun and third parties sell a variety of tools and system services for building complex enterprise and Internet-class applications.

TOOLS

● Visual JavaScript

● Oracle Web Developer

● JavaStudio



SYSTEM SERVICES

● Netscape Directory JNDI

● IIOP, RMI, TCP/IP

● SMTP/IMAP, Java message services

● Security/Crypto

able from third parties, facilitate the development of complex Web applications using server-side JavaScript, CORBA, and Java and native code running through NSAPI.

The other key system behind robust Web applications on Netscape servers is the Netscape Application Server. NAS is a programming environment for objects in Java and C++ that makes applications scalable and fault-tolerant. NAS includes tools for building multitiered applications that integrate HTML, database queries, and business logic on NAS servers.

SUN WEB SERVER

Sun Web Server has been around for a while, although you'd never know it from looking around the Web. According to the Netcraft survey of SSL sites, not a single secure site on the Internet runs SWS. SWS can boast only about 1,000 implementations of any kind, and the vast majority of Solaris Web servers in the sun.com domain run on Netscape Web servers.

Of course, Sun supports Java development on the server. SWS supports servlets, and this makes numerous features, such as CORBA, available to SWS. Servlets are server-side Java programs which, like CGI, output HTML to the browser. Servlets have their own API to access features of the server-side environment. SWS also supports Java Server Pages, a way to access server-side Java features within Web pages, and CGI programs.

Sun is in an awkward position with respect to its Web server, because its partnership with AOL/Netscape commits it

to develop and market Netscape server products. The official policy is that in 1999 both Netscape Enterprise Server and SWS will ship full product upgrades, and that in 2000, Sun will begin to consolidate the product strategies. Considering the relative merits of each product, we think it likely that Sun will create a migration path for SWS customers to Netscape Enterprise Server. Some of SWS's features, such as its CGI alternative Doors, could be ported to Netscape Enterprise Server.

PERFORMANCE

In years past, Windows NT has outperformed Solaris on all of our tests, but this year, with the use of Solaris Network Cache and Accelerator (SNCA), an aggressive Web server cache, SWS was the clear winner on our static page-serving tests. When we ran our dynamic CGI tests under SNCA though, the server rebooted spontaneously. Sun fixed the problem during our testing cycle, but even with SNCA fully enabled, SWS could not outperform IIS on our dynamic or e-commerce tests. In fact, it only improved performance by about 25 percent because the processing load of CGI diminishes the caching value of SNCA.

Neither Netscape nor Stronghold yet supports SNCA, hurting performance relative to SWS. Since Sun has published this API, you should expect performance improvements in these products over time.

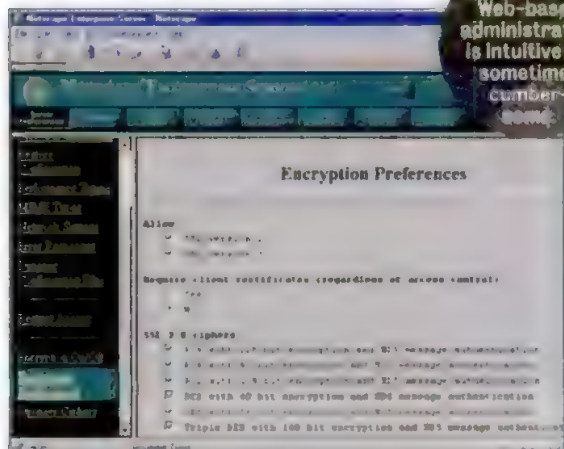
Microsoft Windows NT Server

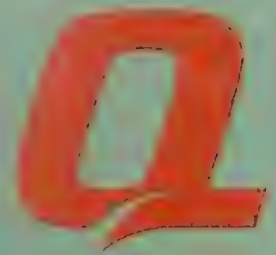


Just a few years ago, Windows NT servers on the Internet were rare, an effort to force the product into a task for which it wasn't suited. But times have changed. Leading performance, excellent programmability, and the widest variety of tools and third-party add-ons make Microsoft Windows NT Server 4 and Internet Information Server 4 (IIS) the best Web platform today.

FOR MICROSOFT-ONLY SHOPS

The lingering perception is that Windows NT is neither secure nor stable enough for a high-traffic Internet site. But there's nothing inherently wrong with Linux, Solaris, or Windows NT that would make any of these OSs more stable than any other. Real-world experience shows that





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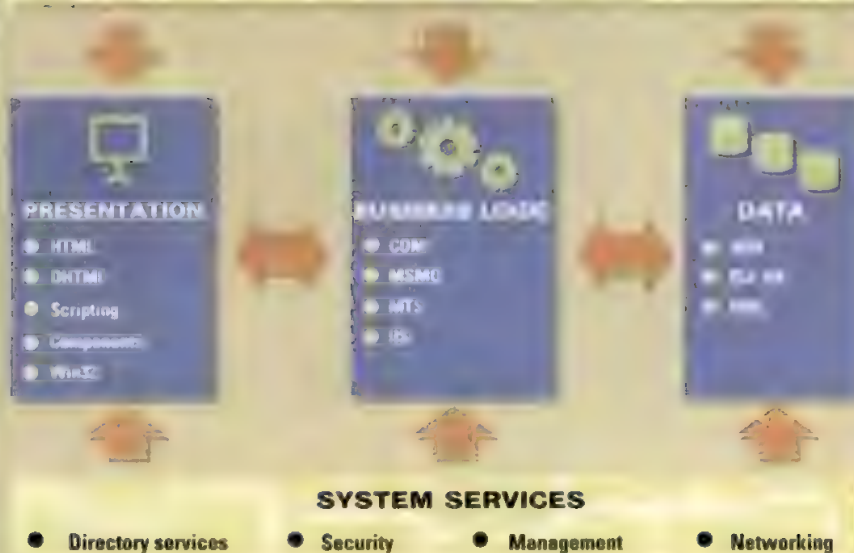
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Although Microsoft offers a complete set of OS services and development tools for building complex, multitier Web applications, you can replace the Microsoft products with third-party alternatives.

- Visual Studio



One key reason for IIS's increasing popularity is its use of Active Server Pages (ASP), Microsoft's technology for creating dynamic Web pages. Key to its success among Web developers is ASP's support of many scripting languages, including JavaScript, Perl-Script, and VBScript, making it easy to access software components residing on external servers. This is done using COM, the standard for Windows component interoperability. Distributed COM, in turn, lets programs use the same method to call components elsewhere on the network, just as if they were local.

Microsoft Transaction Server (MTS) is the best way to execute these components on the server. MTS not only guarantees

transactional integrity (either all the tasks in the transaction are completed successfully or they are all rolled back), but it also has performance benefits, in the form of thread and connection pooling, which make efficient use of resources on the server with no additional work.

Microsoft Message Queue Server (MSMQ) lets you write programs that communicate over slow or unreliable lines. One example of such an application is a RFQ (request for quote) from a customer. To fill that RFQ, you must request price quotes from your suppliers. MSMQ manages all the connections to third parties, even if they are not available 100 percent of the time, by queuing requests through, say, e-mail and returning to your application when all the communications are complete.

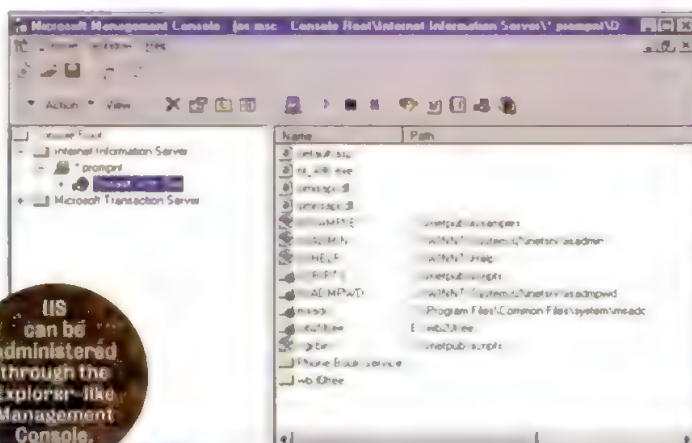
IIS and the rest of Microsoft's server products integrate with Windows NT's security model to give you a single security system. For example, you can use the Windows NT file system (NTFS) to classify users into groups and restrict their access to content.

Finally, Windows NT Load Balancing Services lets you easily build a server farm and distribute the load. Users, however, see a single IP address and have the illusion that there's only a single server. This is especially important for any mission-critical Web applications.

Load Balancing Services isn't a full-blown clustering system though, so it can't work as quickly as one. Windows NT does support industrial-strength hardware and software clustering systems, including Microsoft's own Microsoft Cluster Service, IBM's Netfinity products, and Compaq's Non-Stop products.

Stop products.

The richness of Windows NT's tools and third-party support is a compelling advantage for the platform. Although Microsoft has products at every stage of Web development, you can usually substitute third-party products. Allaire's ColdFusion 4.0, our Editors' Choice among Web development environments, is a good example. No other platform offers this flexibility.



For example, when customers enter their credit card data on your Web site, two actions typically occur. First, you remove the items you're selling from stock and, second, you charge the credit card. If either step fails, you want neither to happen. This constitutes a transaction.

NETSCAPE ON WINDOWS NT

Netscape Enterprise Server on Windows NT is also a heavy-duty Web server with extensive third-party add-ins and tool support, as well as an architecture that supports numerous programming models. For example, apart from the conventional Web

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BENCHMARK TESTS

Web Servers



This issue of *PC Magazine* marks the debut of WebBench 3.0, the product of nearly a year of development at Ziff-Davis Benchmark Operation. This latest release delivers new features and improves some existing ones.

WebBench 3.0 is designed to stress Web servers to the limits of their capabilities. The workload for our static, dynamic, and e-commerce tests consists of over 6,000 files and consumes only 63MB of disk space, so the files can fit into the system memory cache. File sizes within the workload range from 200 bytes to 550K and represent the static content requested 90 percent of the time in actual real-world sites. The dynamic tests do not request purely dynamic pages; instead, they mimic real-world sites that are made up primarily of static pages, mixed with a smaller percentage of pages served by something like CGI, ISAPI, or NSAPI. Our workload consists of 80 percent static and 20 percent dynamic pages.

WebBench 3.0 comes equipped with support for the SSL (Secure Sockets Layer) protocol. This lets you use WebBench to test the performance of secure Web servers. WebBench 3.0 supports both SSL 2.0 and SSL 3.0. To provide its SSL and encryption capabilities, WebBench utilizes BSafe SSL-C 1.0, from RSA Data Communications. Because of U.S. export regulations, however, WebBench can perform only 40-bit encryption.

To test e-commerce servers effectively, we developed an enhanced workload tree and all-new e-commerce test suites. To create our new e-commerce tests, we analyzed secure and unsecured Web server traffic at leading, real-world e-commerce sites like Dell, MSN Expedia, Netsales, and Patagonia.

The e-commerce test suite resembles the dynamic tests but encrypts 8 percent of all data transferred, including some dynamic pages. Additionally, the e-commerce tests produce a different static traffic load than the regular CGI and other dynamic tests.

WebBench can also allow SSL session resumption. This means that with similarly capable Web servers, clients can negotiate an encryption key on the first transaction and then reuse that information for a WebBench-specified number of successive secure transac-

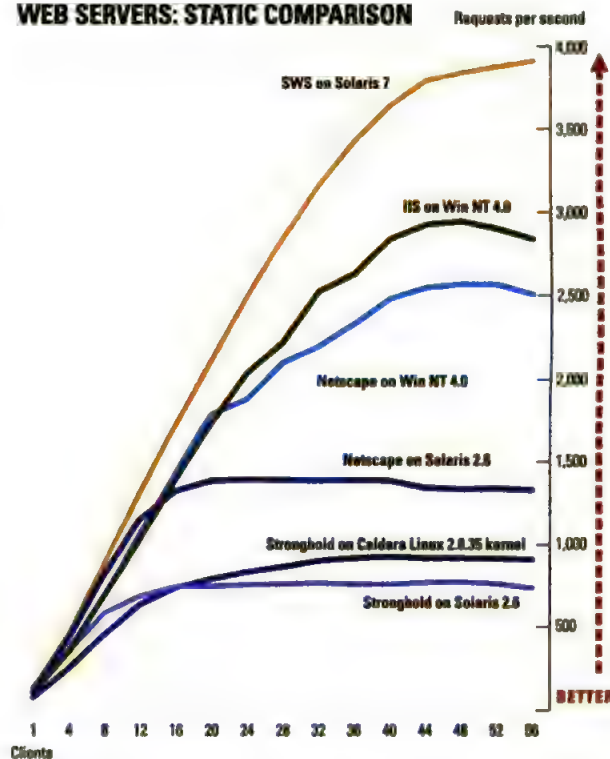
tions. On our tests, the number of times an SSL session is reused was a random number between 5 and 15, inclusive, based on our log file analysis. This reuse saves the Web server from having to perform the computationally expensive re-creation of keys on every SSL transaction.—Kasey Lee

How We Tested

We put WebBench through its paces for a month at ZD Labs in Foster City, California. We tested using 56 clients on four separate 100-Mbps switched networks to stress each Web server, OS, and hardware platform fully. To ensure a fair testing environ-

continues

WEB SERVERS: STATIC COMPARISON



▲ **Static Comparison.** Sun Web out-performed all other products on our static tests. While SNCA's

impact is dramatic in this test, it's not nearly as valuable when dynamic content is considered.

development models of HTML and CGI, Netscape supports server-side JavaScript, IIOP (Internet Inter-Orb Protocol) connections to third-party CORBA software, and excellent user and security management. (For more on Netscape, see our review of Solaris.)

Netscape Directory Server provides one feature that Microsoft will lack until Windows 2000 ships: a hierarchical LDAP directory, which lets you organize your users and resources more flexibly than the flat Windows NT directory does.

PERFORMANCE

Reprising its victory from last year, IIS on Windows NT proved to be the performance leader. Its prowess is due to effective use of threading and efficient handling of file and network I/O. Case in point: In both the dynamic and e-commerce tests, IIS came out on top, especially as we increased the client load.

A complement to threading in Windows NT is its ability to achieve asynchronous I/O. Asynchronous I/O lets a threaded Web server process requests at

the same time it performs file or network I/O. Without this capability, the Web server would sit and wait while the disk subsystem pulled a file from the hard disk or passed the requested file to the network. Instead, the server can work simultaneously on requests from other clients while the I/O subsystem handles the file or network I/O. A similar feature is available in Solaris but has yet to be fully implemented in Linux.

Another advantage of IIS is that it only needs to be optimized for a single platform.

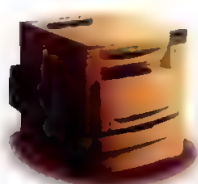
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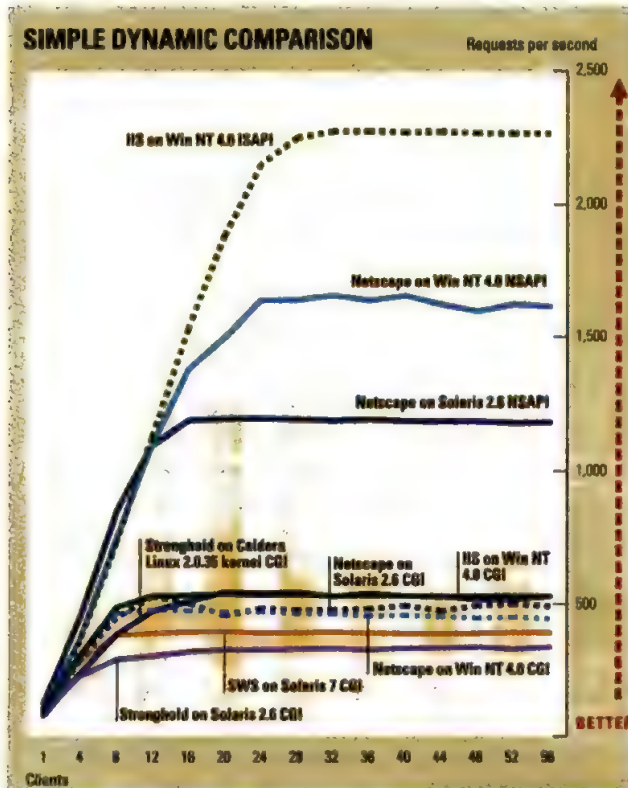
ment, we tuned each product either with the vendor's help or using the vendor's tuning instructions. We also attempted to tune the OS to the requirements of the 100-Mbps network.

To minimize differences between hardware platforms, we used only two servers, a Compaq ProLiant 1850R and a Sun Enterprise 250. The Sun server had two 400-MHz UltraSPARC II processors and 512MB of RAM. The Compaq was similarly configured, with dual 500-MHz Pentium III processors and 512MB of RAM. In the Sun server we used a Sun Quad Port Fast Ethernet PCI NIC, and in the ProLiant, two dual-port Compaq ThunderLAN NICs.

In each test run, we used a single hard disk and made sure that

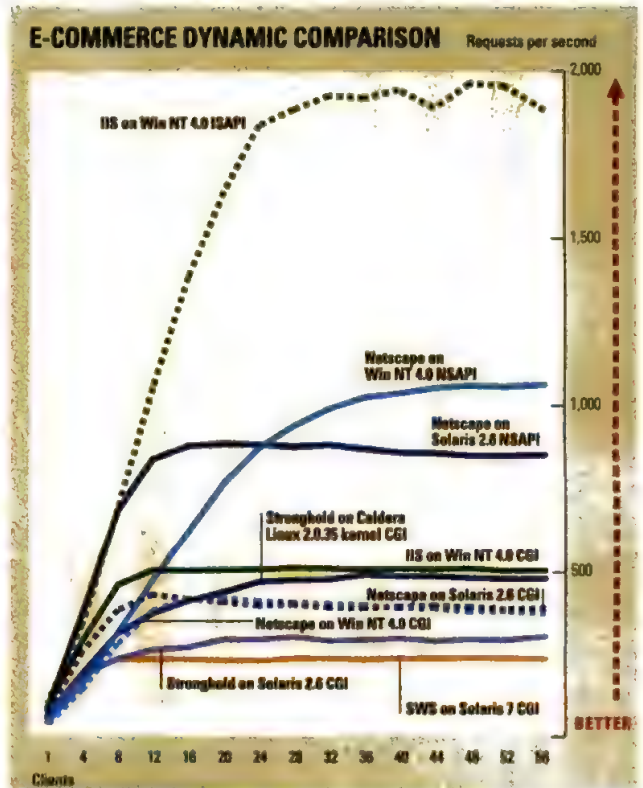
each Web server's cache was tuned high enough to cache the entire workload in main memory. This meant that with a small number of clients, the server would have to hit the disk to read the files into cache. In most cases, the servers could read the entire workload into cache during the first mix and then just serve from memory.

We had to make one slight modification in one of the test suites for WebBench to work properly with Sun Web Server 2.1 (SWS). SWS does not have SSL 2.0 capabilities, so we had to force our e-commerce tests to negotiate SSL 3.0 connections only. Also, SWS does not handle SSL session resumption; it therefore had to generate new encryption keys for every transaction, hurting its e-commerce performance.—Kevin Young



▲ **Simple Dynamic Comparison.** There are a slew of ways to generate content dynamically, and CGI is

among the most common. But in-process APIs perform better, with IIS's ISAPI outdistancing the pack.



▲ **E-Commerce Dynamic Comparison.** The additional burden of SSL only degraded IIS's per-

formance on the Simple Dynamic test by 15 percent on all the platforms.

This may seem fairly obvious, but not having to worry about portability makes performance tuning a much more focused task. Whether you want to sacrifice cross-platform support for performance is up to you.

Linux

● The hot story on the Web this past year has been Linux's growing popularity and its respectability as a platform for Web and enterprise development. Linux has its share of strengths, such as its large open-source developers community and its

price (or lack thereof); and you can certainly build a Web-class application on it. But building such apps with Linux will take more work, and you'll have fewer choices of proven commercial software and won't get the best performance.

We evaluated the features of the Linux 2.2 kernel by reviewing Caldera OpenLinux, Version 2.2, downloading the new kernel, and recompiling it. The Linux 2.2 kernel adds several new performance and scalability enhancements for server applications. (For more details on what's new

in Linux 2.2, see this month's PC Tech column in Solutions.)

APACHE AND STRONGHOLD

The Web server we ran on top of Linux was C2Net's Stronghold Web Server 2.4.1 (\$995 direct, www.c2.net). Stronghold is an SSL-capable server based on the Apache Web server, and C2Net ships the Apache source code with it. Stronghold includes all of the benefits of Apache, including strong support for *virtual hosting* (the ability for a single Web server to serve multi-

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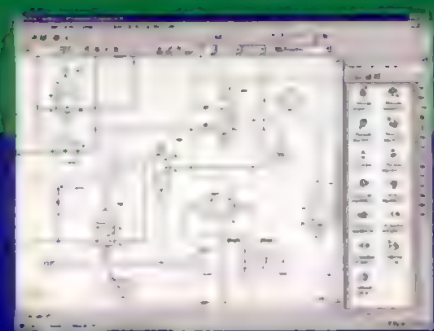
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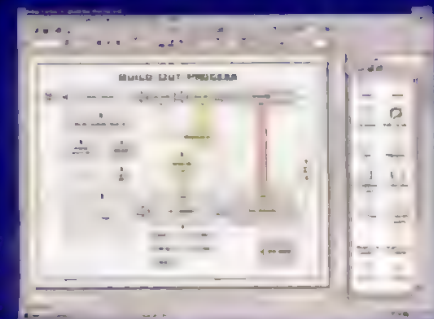
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ple sites at once, such as www.site1.com, www.site2.com, and so on).

Stronghold, like Linux, has a well-deserved reputation for reliability and stability. But Stronghold—and therefore Apache—isn't optimized for multiprocessor environments. So Apache Web sites are likely to scale better by adding more servers than by adding processors.

By contrast, IIS and Netscape Enterprise have multithreaded architectures that are optimized to scale across multiple processors in a single server. This was evident on our tests, where IIS and Netscape generally outperformed Stronghold.

Although Apache lets you tune some parameters (such as the number of processes available to clients), to do so you must edit configuration files. In terms of ease of use, this is a far cry from the Web-based administration that Netscape offers.

And that's just one example of how building a Web platform on Linux is more difficult than it is on Windows NT or Solaris. There are others, too. The problem is that the market for Linux tools is just emerging; so you're forced to cobble together a solution from any available source. And your options are often inferior compared with the tools available for Windows NT and Solaris.

Case in point: IIS and Netscape both offer alternatives to CGI in NSAPI and ISAPI, respectively—in-process API extensions that offer performance benefits. To achieve the same results with Apache, you must take your own native code programs and compile them as modules into the Apache Web server itself, a task that requires a lot more programming knowledge than writing ISAPI and NSAPI scripts does.

That's why very few Linux developers write their own modules, preferring such alternatives as `mod_perl` and PHP. `Mod_perl` is a version of the Perl programming language interpreter compiled into Apache as a module. PHP is a dynamic Web page-scripting language similar to Microsoft's Active Server Pages. PHP comes standard with Stronghold; `mod_perl` is a separate but free download.

Third-party support is improving though, with several companies and open-source groups shipping the middle-tier components you need to build a complex application. For example, MICO ([**LINUX'S WEB PLATFORM**

Linux supports a variety of services, including all the basics, such as those outlined below. Many third parties have announced \(and some have actually shipped\) middle-tier services.

TOOLS

- JavaTools \(Penumbra, Sun JavaWorkshop\)
- Perl
- Metrowerks CodeWarrior

PRESENTATION

- HTML
- DHTML
- Scripting

BUSINESS LOGIC

- CORBA \(MICO, BEA\)
- Oracle Web Application Server
- IBM MQ Series
- WebLogic Tengah

DATA

- JDBC/ODBC
- PL/SQL
- XMI

SYSTEM SERVICES

- TCP/IP
- File systems
- Java services
- Messaging](http://www</p></div><div data-bbox=)

mico.org) is shipping a CORBA-compliant object request broker (ORB).

Developing your middle tier in Java is just now emerging as a viable option on the Linux platform. Apache Jserv is a Java Servlet engine for Apache (currently available in beta from the Java Apache Project, java.apache.org).

The servlet engine compiles into Apache as a module and works with any JDK 1.1-compliant Java VM. Licensing issues prevented the Java Apache Project from shipping the SDK for developing servlets, but this is available at java.sun.com.

PERFORMANCE

As we mentioned before, when it comes to performance, the Apache-Linux duo doesn't quite stack up. Not yet.

A few weeks before our testing began, Linus Torvalds (creator and keeper of the Linux kernel) released the Linux 2.2 kernel. It promised to overcome the lack of multiprocessor scaling that has hampered performance on our previous tests.

Unfortunately, we could not test the potential improvement in processor scaling, as the 2.2 kernel included a TCP/IP stack improvement that broke

its communication with our Windows 95 clients. This fix was not in the 2.0 kernel, which was the latest available in standard distributions during our testing, so we tested with Caldera's 2.0.35 kernel distribution.

Despite our not being able to take advantage of Apache's full processing potential, Stronghold/Apache did fairly well. On our CGI tests, Stronghold held its own against the competition. But on static tests, it fell far behind Netscape and Sun Web Server on the same hardware platform.

Some performance loss can be attributed to Apache's process-based architecture. A process model incurs more overhead than a threading model because threads permit more memory to remain local (that is, in the processor and memory caches). Since Version 1.2.4, Apache has adopted a new model, in which the server launches a number of processes even if the server load isn't high enough to need them. During our tests, we made sure that enough processes were preallocated to avoid new process creation, but managing the processes still requires more CPU time than thread handling does. **PC**

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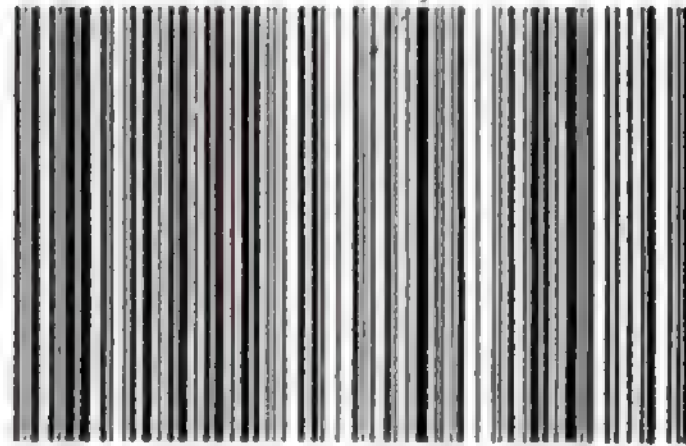
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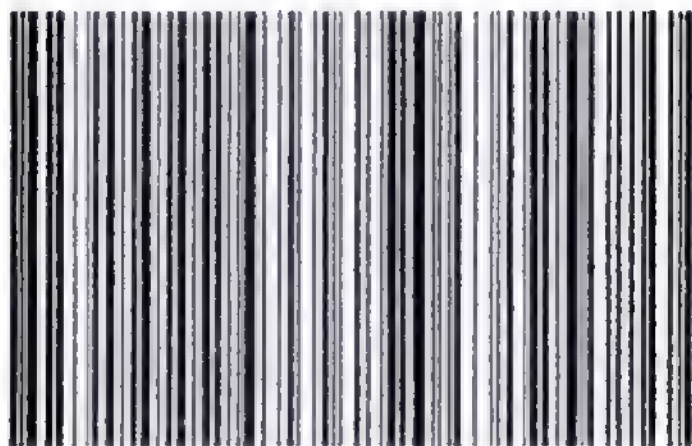
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Inverted Back

1. Follow instructions on the other side

Folded edge of the page



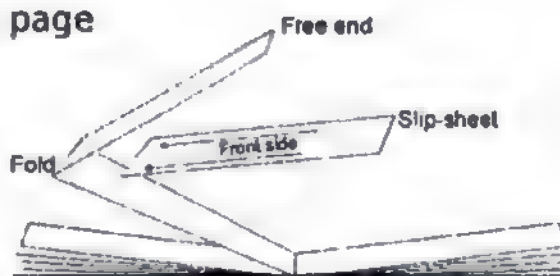
Inverted Foldout slip-sheet

Foldout slip-sheet



1. Open the foldout page
2. Insert this sheet with
 1. Front side touching the free page
 2. Arrow pointing to the fold
3. Slice the folded edge
4. Close the page and slip-sheet

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2. Insert this sheet with
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Network Printers

From small workgroups to large departments, offices rely on monochrome laser printers.

We test **27** of them....

BY JAMES KARNEY

This year, to a greater degree than ever, comparing network printers is about much more than prices and engine speeds. Easy setup, remote management capability, processing power, robust paper handling, and

Internet integration separate the best products from the rest of the pack.

REVIEW CRITERIA

PC Labs tested 27 monochrome network laser printers, mainly with rated engine speeds of 12 to 40 pages per minute (ppm). The exception was the 10-ppm HP LaserJet 2100TN, which according to Hewlett-Packard performs on the same level as most 12-ppm



The Tektronix Phaser 740L offers an upgrade to color printing.

PHOTOGRAPH BY THOM O'CONNOR

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units (though our tests found otherwise). The printers fall into two general categories: Those with engine speeds of up to 25 ppm are best suited to small or medium-size workgroups, while printers with 32- to 40-ppm engines can handle the needs of an entire department.

For this roundup, 15 companies submitted a total of 27 printers, 2 of which—the Canon imageRunner 400E and the Toshiba DP2460—are multifunction devices based on digital copier

technology. Both of these units provide scanning, copying, and faxing capabilities in addition to printing. Kyocera had 2 eligible printers still in development at the time of our testing and therefore unavailable for review.

A Place for Every Printer

The 27 monochrome network laser printers featured in this roundup vary greatly in output speed and functionality, from a simple 12-ppm printer to a 40-ppm multifunction unit. There are machines suited for every work situation, from a small workgroup to an entire department of a large corporation. Here's our take on basic printer requirements for a few typical office scenarios.

Department:

- Monochrome network printer: 25 to 40 ppm (\$1,500 to \$4,095).
- Ledger-size capability (standard), duplex (standard), mailbox (standard).
- Recommended: Sorter/mailbox (\$1,299), envelope feeder (\$150), hard disk (\$500).
- Color network printer: 4 ppm color, 12 to 16 ppm monochrome (\$1,000 to \$4,500).
- Recommended: Hard disk (\$500).

Small workgroup:

- Monochrome network printer: 12 to 16 ppm (\$800 to \$1,500).
- Recommended: Duplexer (\$400)

Medium-size workgroup:

- Monochrome network printer: 17 to 20 ppm (\$900 to \$1,600).
- Recommended: Duplexer (\$400), sorter/mailbox (\$1,299), envelope feeder (\$150)

ARE THEY MANAGEMENT MATERIAL?

With more and more novices setting up Windows-based networks, vendors are doing everything possible to make adding a printer to the network as painless as possible. Physically setting up Lexmark's Optra printers took us less than 3 minutes and was simply a matter of pulling out and reseating the toner cartridge, plugging in the power cord, stacking the paper trays under the unit, and flipping the power switch. Configuring

the Optras on the network was almost as simple, thanks to Lexmark's top-notch

MarkVision software. MarkVision automatically configures the printer for either NetWare or Windows

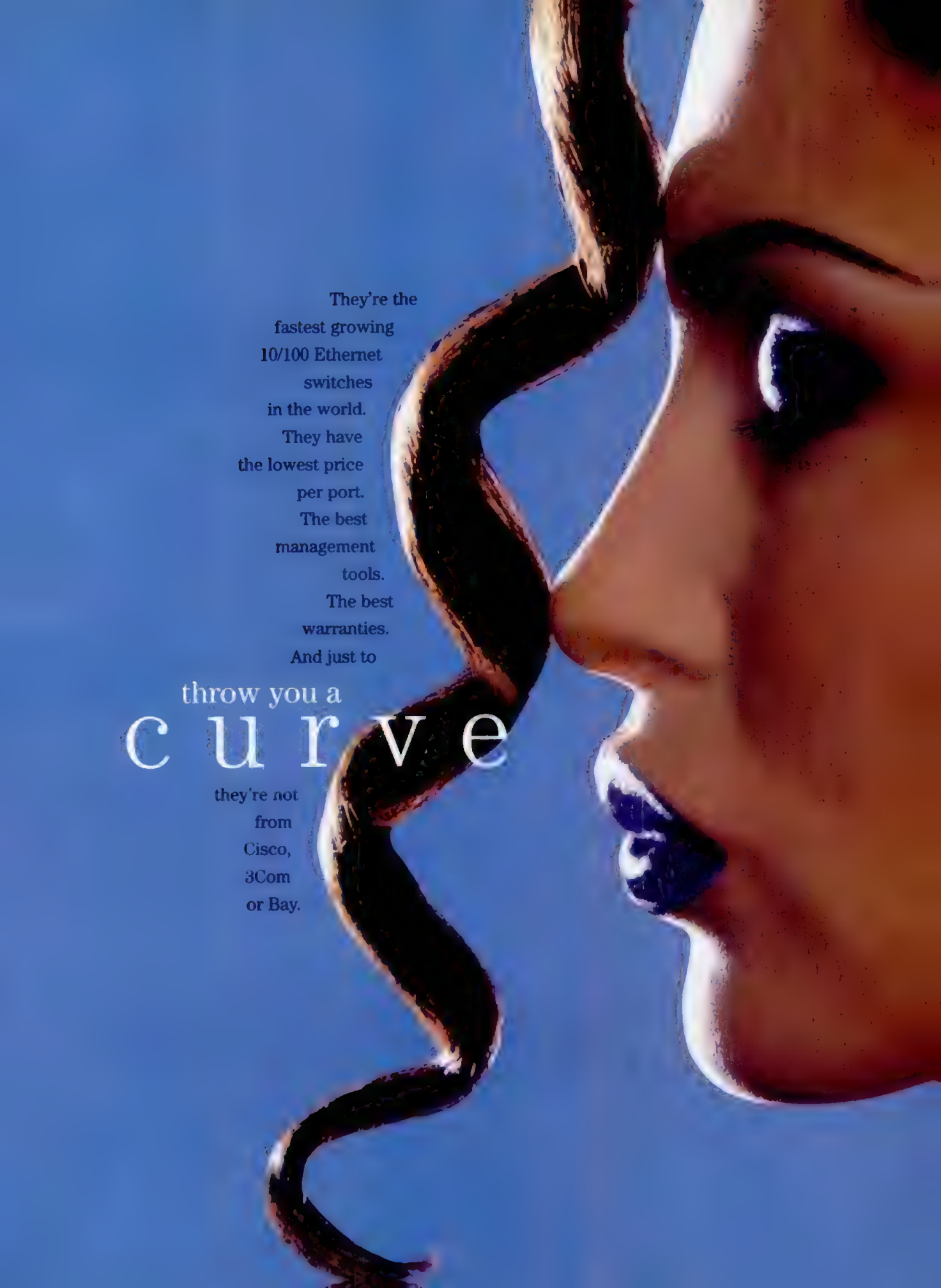
NT—there's no need to know the ins and outs of the operating systems. Hewlett-Packard, always a leader in network management software, provides a slick wizard that detects a new printer and starts loading drivers as soon as the printer is plugged into the network.

Printers from IBM and Xerox were also notable for their management software, though their programs weren't as robust as those from HP and Lexmark. Still, as our reviews point out, some units, such as those from Genicom and Xanté, were more of a challenge than a delight to assemble; configuring these tested our patience.

The reach of better printer management tools is improving as well. Most of the products we tested (20 out of 27) have internal Web pages that you can view with a browser to check on the status of jobs and toner levels and to adjust settings. And with the exception of the Xanté printer, all the units send alerts to notify managers when toner or paper run out.

THE SPEED FACTOR

Engine speeds have not increased drastically over last year's models, but raw engine speed is not the only way to measure performance. Vendors are finding ways to do more of the processing work in the printer, which reduces network loads. Faster processors and better firmware reduce the performance hit that comes from large graphics or multiple fonts. During our speed tests, some products—most



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notably the Lexmark Optra S 1855n—ran almost as fast handling a stack of mixed jobs or a duplexing job as they did on a single long text document.

Some performance gains are due to improved job handling—pushing simple files ahead of long or complex tasks. The Brother HL2060 and the HP line use *RIP* (raster image processor) once, print many (sometimes referred to as *mopier*) technology, which speeds up jobs with multiple copies and reduces the load on the network and server. With a hard disk, it is now possible to store a job on the printer, then call it up as needed. Hard disks are options for most of these products but come standard on the Hitachi Koki and Toshiba units. Features like these used to be in the province of high-speed department and enterprise models. Now they are showing up on better workgroup products as well.

PLENTY OF PAPER OPTIONS

Advanced paper-handling tools are also making the migration to less expensive models. One popular add-on is the duplexer, once limited to high-end models. With more users pumping out Web pages and long documents, duplexers cut paper costs. Among the printers we review, only the NEC SuperScript 1260N and the Toshiba DP2460 fail to offer duplexing options.

Multifunction capabilities such as scanning, faxing, and copying extend the use of printers. But be prepared to pay for these options: The Canon unit sells for more than \$17,000 and the Toshiba machine for about \$8,000. If you regularly use letter-head stock or some other special media, consider adding extra paper trays and shopping for a model, such as the HP LaserJet 4050TN, that lets you designate a bin for specific media. The major manufacturers stack accessories like paper bins and

Home office:
■ Personal ink jet printer (\$100 to \$500).
■ Internet connection.



duplexers under the main unit, so upgrading is hassle-free.

NETWORK MEETS INTERNET

Already, remote printer management via a Web browser is possible; Internet printing is not far behind. The Internet Printing Protocol (IPP) is an emerging standard that enables print jobs to be sent from a PC to a remote printer via the Internet. Perceived as a replacement for the fax, Internet printing could be a boon for the business traveler or companies with multiple branches (see the sidebar “Internet Printing Is (Almost) Ready” in our story “Color Network Printers,” May 25, 1999). Hewlett-Packard already implements this technology, and most other manufacturers should support IPP under Windows 2000.

It was easier to buy a network printer when pages per minute and dots per inch were the key factors, but finding the best of the breed for your needs today is worth the extra homework. We can’t stress enough the importance of robust management tools. They were a pivotal factor in our decision to award Editors’ Choice status to the HP LaserJet 5000GN and 8100DN and the Lexmark Optra S 1855n. The reviews and performance test results on the following pages should help you find the ideal printer for your workspace.

Editors’ Choice

- Workgroup: HP LaserJet 5000GN, Lexmark Optra S 1855n
- Departmental: HP LaserJet 8100DN



If you are looking for a printer for your office or workgroup and you need the versatility of tabloid-size output, our Editors’ Choice is the HP LaserJet 5000GN (\$3,350 street, with the network adapter card and duplexer). This 16-ppm unit earned decent performance

test scores, produced crisp 1,200-dpi text and sharp graphics, and has a sleek, stackable design that accommodates multiple input trays and a duplexer. For offices that regularly print large spreadsheets of desktop publishing layouts, the 5000GN delivers full-bleed 11-by-17 images. Hewlett-Packard’s outstanding JetAdmin management software provides top-notch setup and administration of the 5000GN.

Honorable mention goes to the Tektronix Phaser 740L (\$1,500 street), a 16-ppm machine that can be upgraded to a full-color printer with a simple \$550 color cartridge.

For workgroups that don’t require a tabloid-size printing option, our Editors’ Choice remains the same as last year: the

Lexmark Optra S 1855n (\$2,830 street, with a duplexer and two 500-sheet input trays). This 18-ppm machine is fast: It even outperformed some printers in the departmental category on a number of our speed tests. The paper-handling options are excellent, with extra trays and the duplexer conveniently stacking beneath the unit. Setup and administration with Lexmark’s MarkVision utility are totally hassle-free.

Our Editors’ Choice for departmental printing is the HP LaserJet 8100DN (\$3,450 street). This 32-ppm printer produces nearly flawless text and graphics (though PostScript 3 files were problematic), and it comes outfitted with a duplex-er and 3,100-sheet capacity. And the JetAdmin management software is unsurpassed.

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Brother HL1660e, HL2060

HL1660e: 17 ppm; 1200x600 dpi; legal-paper; basic configuration, \$890 street; tested configuration, \$1,970. **HL2060:** 21 ppm; 1200x600 dpi; legal-size paper; basic configuration, \$1,100; tested configuration, \$3,100. Bridgewater, NJ; 800-226-7746; www.brother.com.

● Brother International Corp.'s mono-chrome laser printers are well suited for their target market of large workgroups or small departments of 10 to 20 users. Both have optional network interface cards with competent network management software, though both were outperformed on our speed tests by lesser-priced, comparably equipped Xerox and IBM printers.

It's simple to set up these printers, from installing toner cartridges and adding network interface cards to sliding in the extra paper trays. Most users should be able to



With all the paper-handling options installed, the HL2060 is a versatile printer.

handle these tasks, though installation onto a NetWare network will likely require help, as setup is not wizard-based. (According to Brother, most of the company's network printers are installed by VARs or network-experienced personnel, not by end users.) The installation software and documentation are sufficiently detailed, and both printers successfully use DHCP to configure IP addresses with Windows NT. After installation, the printers are accessible via the Internet for remote management and troubleshooting.

We expanded both of our tested print-

ers to their maximum 72MB of RAM; the use of standard 72-pin SIMMs keeps this option relatively inexpensive. Besides having two standard paper trays (150-sheet multipurpose and 500-sheet main), each was equipped with an optional \$330 tray, boosting capacity to 1,150 sheets. Both printers are PCL 6-compatible, and each comes with Brother's BR Script, which is compatible with PostScript Level 2.

The HL1660e has a maximum resolution of 1,200 by 600 dpi, while the higher-end HL 2060 has a top resolution of 1,200 by 1,200 dpi. With all available options installed, including a ten-bin mailbox/collator, the HL2060 is truly ready for versatile network mopier duty. We tested it with Brother's optional automatic duplexer and with the ten-bin mailbox, which installs on the top of the printer above the paper output tray. (Both options are typically installed by VARs.) The duplexer worked without flaw, and we were able to use the bins on the mailbox for collating print jobs. The bins can also be individually configured for specific users, or they can be mixed—for instance, with six bins allocated for collating and four bins for individual users. Surprisingly, however, the status of specific user bin assignments is viewable only on individual client machines, not across the network.

With print quality on a par with the other printers tested and with fair prices given their print speeds and paper handling, both the HL1660e and HL2060 are reasonable choices for network installations. The mailbox option of the HL2060, even with its client-limited bin configuration, adds significant flexibility to this capable printer.—Bruce Brown

Canon ImageClass 4000, ImageRunner 400E

ImageClass 4000: 32 ppm, 600 dpi, ledger-size paper; basic configuration, \$2,460 street; tested configuration, \$2,750.

ImageRunner 400E: 40 ppm, 600 dpi, ledger-size paper; basic configuration, \$17,200; tested configuration, \$24,910. Lake Success, NY; 800-652-2266; www.usa.canon.com.

● The Canon imageClass 4000, from Canon Office Systems Group, is a jour-



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Whatever computer product you're buying, PC Magazine Online is the site to see for comprehensive, labs-based reviews. To learn more about network printing, check out these other sites.

► PC Technology Guide: Laser Printers

www.pctechguide.com/12lasers.htm

This useful page provides an extended, illustrated explanation of the history and technology behind laser printers, including the print engine, consumables, and printer languages like PostScript and PCL.

► The Internet Engineering Task Force

<http://ietf.org>

This somewhat dense, dry site discusses the latest efforts to set universal standards for data transmission on the Internet, including progress in standardizing and implementing an Internet Printing Protocol (IPP).

neyman printer, easily customizable to suit the needs of an entire department. The Canon imageRunner 400E is a multi-function unit based on digital copier technology. It requires extensive support from a dealer for installation and service (such as changing the drum), though the cost of dealer installation is included in the purchase price. Both printers boast sturdy construction, robust management tools, above-average speed, and excellent print quality.

Anyone who can set up a print queue can install either printer on a network; both server and workstation installation under NetWare and Windows NT are made simple using Canon's administration software NetSpot. NetSpot can monitor all MIB devices on your network, and it can limit searches to your LAN or to your entire company's WAN. NetSpot shows printer features (paper size and amount but not media type), lets you manage jobs in the print queue and specify finishing functions like stapling and collating.

The imageClass 4000 is a bulky, heavy laser printer that accepts ledger-size paper and includes a one-piece slide-in drum-and-toner cartridge. Installing the options is easy; even the duplexers slides in as easily as a toner cartridge. The unit lacks support for Inter-

Our Contributors: JAMES KARNEY is a frequent contributor to *PC Magazine*. BRUCE BROWN, STEPHEN W. PLAIN, ALFRED POOR, WINN L. ROSCH, and M. DAVID STONE are contributing editors of *PC Magazine*. JOHN GLIEDMAN and DAVID A. HARVEY are freelance writers. S. JAE YANG was the project leader, and JENNIFER TRIVERIO was the associate editor in charge of this story.



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Network Printers

net printing, however. During speed tests, the imageClass 4000 was exemplary, ranking near the top of its category on most tests. Print quality was excellent for 600 dpi—sharp and blemish-free, even on full-page blacks.

The higher-end, ledger-size imageRunner 400E needs to be set up by the dealer. Once the printer is up and running, its speed and quality match those of its smaller sibling. Function is superb whether printing or copying. The standard Canon control panel is intuitive, and the printer has better management and Internet readiness than its sibling, with its own Web server on an integrated 2.1GB hard disk and with associated WebTools software, which gives full printer and queue control.

A dexterous multifunction machine, the imageRunner 400E can switch between tasks easily. It can queue a single copy operation during printing, then roll out the copy when the print job's done. A bypass mode (with a special output tray) lets you interrupt printing for urgent copies. The printer can also scan and transmit faxes while printing and can queue received faxes on its hard disk. A mailbox system adds extra security; for example, you can publish a memo but require each recipient be at the machine (to activate a personal mailbox) in order to get a printout.

Either of these Canon printers is sturdy enough for heavy departmental use—and either is likely to be a good choice where quality and speed are chief concerns.—Winn L. Rosch

Compaq LN16, LN32

LN16: 17 ppm, 600 x 600 dpi, legal-size paper, basic configuration, \$1,250 street; tested configuration, \$2,180. **LN32:** 32 ppm, 600 x 600 dpi, ledger-size paper, basic configuration, \$2,652; tested configuration, \$6,082. Houston; 800-345-1518; www.compaq.com, www.printers.digital.com.

● The Compaq LN16 and LN32 are network printers that aim successfully at departments of 20 to 30 and 20 to 50 users, respectively. Both printers are rebranded Genicom models with a modular design that speeds setup and configuration. At the time of our testing, however, Compaq had not yet released its management software—a key component in the vendor's network printing solution.

The LN32 accepts more high-volume



The **setup** rating takes into account the process of installing the printer (toner cartridges, paper-handling options) and configuring it on NetWare and Windows NT networks. Is the documentation accurate and useful to network novices? Better printers have wizard-based installation routines that automate setup with minimal intervention.

The **management** rating reflects the breadth and depth of the printer's network administration utility. We look

for a wide range of reported alerts and conditions, plus the ability to recognize and control other brands of printers on the network. A browser-based utility is a plus.

Print quality indicates how well the printer produced typical monochrome business documents (reports, charts, presentation slides, and photos) both in default settings and when we tweaked the driver settings.

For **paper handling**, we take into account the printer's standard paper capacity as well as its options (such as duplexers and sorters). The ability to print on oversize media is a plus.

	Setup	Management	Print quality	Paper handling
Brother HL1660n	Excellent	Good	Good	Good
Brother HL2060	Excellent	Good	Good	Excellent
Canon imageClass 4000	Good	Good	Excellent	Good
Canon imageRunner 400E	Excellent	Good	Excellent	Excellent
Compaq LN16	Excellent	N/A	Excellent	Good
Compaq LN32	Excellent	N/A	Excellent	Excellent
Genicom microLaser 170N	Fair	Fair	Good	Excellent
Hitachi Koki DDS 32	Excellent	Excellent	Excellent	Good
HP LaserJet 2100TN	Excellent	Excellent	Good	Good
HP LaserJet 4050TN	Excellent	Excellent	Excellent	Excellent
EDITORS' CHOICE HP LaserJet 5000GN	Excellent	Excellent	Excellent	Excellent
EDITORS' CHOICE HP LaserJet 8100DN	Excellent	Excellent	Excellent	Excellent
IBM Infoprint 20	Good	Good	Fair	Fair
IBM Infoprint 32	Good	Good	Good	Good
IBM Infoprint 40	Good	Good	Good	Good
Lexmark Optra K 1220n	Excellent	Excellent	Fair	Good
EDITORS' CHOICE Lexmark Optra S 1855n	Excellent	Excellent	Good	Excellent
Lexmark Optra Se 3455n	Excellent	Excellent	Good	Excellent
Mincita PageWorks 25	Good	Fair	Excellent	Excellent
NEC SuperScript 1260N	Excellent	Good	Good	Excellent
QMS 3260EX	Excellent	Good	Excellent	Good
QMS 4032	Excellent	Good	Excellent	Good
Tektronix Phaser 740L	Excellent	Good	Excellent	Fair
Toshiba DP2460	Excellent	Fair	Excellent	Fair
Xante Accel-A-Writer 3DN	Fair	Poor	Fair	Fair
Xerox DocuPrint N17	Excellent	Good	Good	Good
Xerox DocuPrint N40cn	Excellent	Good	Good	Good

N/A—Not applicable: The product does not have this feature.

options and is more suited to demanding enterprise use. It can hold 3,500 pages with the optional high-capacity feeder, and it can handle ledger-size media. The LN16 can accommodate 1,150 pages and legal-size media, and its duty cycle is only a quarter of the LN32's rated 150,000 pages per month.

We set up the LN32, complete with duplexer, high-capacity feeder, and high-capacity finisher/stapler, in mere minutes, thanks to stackable drawers and quick

connections. In this configuration, the LN32 is a formidable printing solution for your department.

The LN16 lacks the finisher options but is similarly smooth to set up. Both units come with comprehensive documentation in printed and CD format. The LN16's duplexer, which attaches to the rear of the unit, feeds pages out the back, then retrieves them for printing on the other side. This technique can make clearing paper jams much easier,

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PERFORMANCE TESTS

Network Printers



When speed counts, the Xerox DocuPrint N40cn tops all departmental printers. The Lexmark Optra Se 3455n and Optra S 1855n stand out in their classes for both speed and image resolution.

What the Numbers Mean

We categorized the printers with engine ratings of 32 ppm or above as *departmental* printers. Those with engine speeds of 20 to 25 ppm are categorized as *medium-size-workgroup* printers, while those rated 18 ppm and under are *small-workgroup* units. In analyzing print speeds, we compared the printers within each category.

There is more to printer performance than the raw engine speed. Here we report the results from our suite of measurements devised to expose the subtle differences in performance profile of the network printers in this roundup. Each test reveals a printer's suitability to a specific task.

We requested that each vendor submit its products in a configuration it saw as "typical," which does not necessarily coincide with the most basic configuration. We also asked the vendor to set up the printer on our test-bed in the same way it would be configured in an office environment. For each test, we measured the "click-to-clunk" time, which starts the moment you click the OK button in the print dialog box and ends the moment the last page is released to the output tray. In the performance test charts, we present the data in "effective pages per minute," calculated from the click-to-clunk time, which includes the latency at the beginning of each print job.

MICROSOFT WORD TEXT-ONLY (12 PAGES)

As most print jobs in the real-world office environment are small documents, the inherent latency in printing is vital information in evaluating the speed of network printers. By *latency* we mean the time required for the printer to produce the first page.

Both the Xerox DocuPrint N40cn and the IBM Infoprint 40 demonstrated lightning quickness in cranking out the first page in 7 seconds and 11 seconds, respectively. (Most printers required 20 seconds or longer to produce the first page.) The quick start allowed the two departmental printers to distance themselves

from the QMS 4032 Print System by more than 5 ppm. The IBM Infoprint 32 also stood out, with a relatively fast first-page-out time of 10 seconds.

Among the medium-size-workgroup printers, the Toshiba DP2460, with a 24-ppm engine, took over a minute to get the first page out and yielded a meager 7.9 ppm. In the small-workgroup category, the 16-ppm-rated Tektronix Phaser 740L, with a slow first-page-out, did not perform significantly better than the HP LaserJet 2100TN, the printer with the lowest speed rating in the roundup (10 ppm).

MICROSOFT WORD TEXT AND GRAPHICS (12 PAGES)

By comparing the 12-page Text and Graphics test results with the 12-page Text-Only test data, we can filter out the print engine speed and expose the printer's ability to process complex graphics documents. The performance on this test can be attributed mainly to the driver efficiency, the printer CPU's rasterizing performance, and network proficiency. Having more memory also helps reduce the networking overhead in transporting the print job data.

Among the departmental printers, both the Xerox DocuPrint N40cn and the QMS 4032 Print System maintained good speed with the graphics document, but others, such as the IBM Infoprint 40 with the base memory of only 16MB, slowed down significantly when asked to rasterize graphics during the 12-page text and graphics job.

The departmental entries from Lexmark, Canon, and QMS showed minimal degradation in printing the graphical 12-page job. The Lexmark Optra S 1855n and the HP LaserJet 4050TN led the way among small-workgroup printers in processing graphics documents, but the Compaq LN16 gave up a lot of speed for printing graphics-rich documents. Other printers with the same problem included the Brother HL2060, the Compaq LN32, the Hitachi Koki DDS 32, the IBM Infoprint 32, and the Minolta Pagemworks 25, all of which fell sharply when graphics elements were introduced to the print job.

MICROSOFT WORD TEXT AND GRAPHICS (43 PAGES)

The 43-page Text and Graphics test is a good indicator of a printer's sheer print engine speed. The test document consists mostly of text and yields a highly compressible print job.

Three of the departmental printers—the IBM Infoprint 40, the QMS 4032 Print System, and the Xerox DocuPrint N40cn—performed identically, at 29.7 ppm. The Canon imageRunner 400E, a 40-ppm multifunction departmental unit, lagged behind those three departmental printers, at 23.9 ppm.

Despite being tested at the higher default resolution of 1,200

but it may cause some problems in cramped quarters.

Compaq's Remote Control Print Management Software was not ready for our testing, even in a beta version. But the vendor predicts that it should be available and shipping with both models by the time you read this. The software is expected to deliver SNMP management of Compaq and other compliant printers, event monitoring and logging, and

remote configuration. It is planned to be a TCP/IP-only program, however. At PC Magazine Labs, we were able to configure the LN32, using its built-in home page via a standard Web browser. Both printers were a snap to configure on both Windows NT and NetWare, thanks to fine documentation.

Our testing went without a hitch. Both Compaq models produced crisp text and well-balanced graphics. The

LN16 was far closer to its reported speed rating, however. Our 43-page Microsoft Word text and graphics document printed at 14.4 ppm on the LN16, while the LN32 delivered only 18.7 ppm—only 58 percent of its 32-ppm rating.

Of the two units, the Compaq LN32 is the more compelling solution. But without real management software, both printers are unfinished works for network use.—WLR



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PERFORMANCE TESTS

Pages per minute High scores are best. Bold type denotes first place. ■ denotes Editors' Choice.	Rated engine speed (ppm)	Resolution (tested, in dpi)	Microsoft Word		Outlines text and graphics (16 pages)	Mixed simultane- ous jobs	Microsoft Power- Point (6 pages)
			Text only (12 pages)	Text and graphics (12 pages)	Text and graphics (43 pages)		
Brother HL1660e	17	600	12.0	9.1	12.5	N/A	6.1
Brother HL2060	21	600	15.7	8.4	14.0	8.2	5.7
Canon imageClass 4000	32	600	19.5	18.0	25.5	N/A	8.5
Canon imageRunner 400E	40	600	17.1	12.4	23.9	9.4	9.5
Compaq LN16	17	600	12.4	6.7	14.4	2.5	3.3
Compaq LN32	32	600	14.7	6.0	18.7	6.9	6.3
Genicom microLaser 170N	17	600	12.6	10.9	12.5	N/A	3.6
Hitachi Koki DDS 32	32	600	14.7	7.9	20.5	4.0	4.7
HP LaserJet 2100TN	10	600	8.5	7.3	9.4	N/A	1.8
HP LaserJet 4050TN	17	600	12.9	12.6	15.1	8.6	5.1
■ HP LaserJet 5000GN	16	600	12.2	11.6	14.3	7.4	4.1
■ HP LaserJet 8100DN	32	600	18.9	16.0	25.3	11.2	5.9
IBM Infoprint 20	20	600	14.1	10.3	17.7	2.5	5.5
IBM Infoprint 32	32	600	24.8	12.2	25.3	2.8	6.9
IBM Infoprint 40	40	600	25.7	12.4	29.7	2.8	6.8
Lexmark Optra K 1220n	12	600	9.7	8.7	11.4	N/A	3.6
■ Lexmark Optra S 1855n	18	1,200	12.9	13.1	15.7	12.0	7.2
Lexmark Optra Se 3455n	34	1,200	18.9	18.5	26.3	15.7	9.5
Minolta PageWorks 25	25	600	17.1	10.7	19.7	5.4	6.0
NEC SuperScript 1280N	12	600	9.6	7.3	10.9	N/A	6.3
QMS 3260EX	32	600	17.6	17.8	25.3	9.1	6.2
QMS 4032	40	600	20.0	20.6	29.7	8.9	6.5
Tektronix Phaser 740L	16	600	8.7	9.4	12.8	N/A	3.8
Toshiba DP2460	24	600	7.9	5.2	10.1	5.6	4.5
Xanté Accel-A-Writer 3DN	20	600	11.8	9.9	16.3	N/A	3.2
Xerox DocuPrint N17	17	600	12.0	10.4	14.9	2.4	3.8
Xerox DocuPrint N40cn	40	600	26.7	22.5	29.7	2.7	5.5

N/A—Not applicable. This model does not include an automatic duplexer.

▲ The results as evidenced by the table, the **Xerox DocuPrint N40cn** posted impressive numbers. The workgroup-class **Lexmark Optra S 1855n**—one of

our Editors' Choice selections—also shone, although it prints at a higher default resolution than the others.

dpi (compared with 600 dpi for others), the Lexmark Optra Se 3455n held its own among the other departmental printers. The 24-ppm-rated Toshiba DP2460 produced a disappointing 10.1-ppm score, thanks to a first-page delay of over 2 minutes.

Also with a higher default resolution of 1,200 dpi, the Lexmark Optra S 1855n led the pack among small-workgroup printers, with a score of 15.7 ppm.

DUPLEX TEXT AND GRAPHICS (16 PAGES)

The engine speed becomes less relevant in the duplexed job performance, which depends more on the paper-handling speed. Whereas most manufacturers seem to retrofit their printers with duplexers almost as an afterthought, a few printers are engineered to duplex with little time penalty.

Genicom microLaser 170N

17 ppm, 600 dpi, legal-size paper, basic configuration
\$1,200 street (as tested) Chantilly, VA, 800 436 4266,
www.genicom.com

● Sometimes the old adage really is true: You get what you pay for. A case in point is the Genicom microLaser 170N. This no-frills printer combines acceptable business printing quality with a printing cost of 1.16 cents per page, plus

paper, and a 35,000-page-per-month duty cycle. What you sacrifice for the low cost is network configuration and administrative tools.

The 170N comes ready to connect to a desktop or laptop printer port. But if you are a network neophyte, you will need help configuring the printer on a network. The printer documentation, though accurate, presupposes just enough familiarity with a network OS to

baffle and frustrate novices. Genicom does promise that its EZWebCon network configuration software, aimed at the network rookie, will be available later this year. Don't expect any help in administering print jobs on your network, either: The 170N doesn't ship with any network management tools.

On our tests, the 170N's performance was a mixed bag. The Fujitsu PostScript emulation produced crisp text and busi-

The HP LaserJet 8100DN and Lexmark Optra Se 3455n turned in the best duplexing performance (over 10 ppm each) among the departmental printers. Though fast everywhere else, the Xerox DocuPrint N40cn and the IBM Infoprint 40 were disappointing duplexers. Like its departmental counterpart, the Lexmark Optra S 1855n turned in the best duplexing performance in the small-workgroup category.

MIXED SIMULTANEOUS JOBS

The printers with greatest proficiency in handling jobs from a heterogeneous network win here. On this test, a printer must switch between IPX and IP protocols in receiving jobs. The printers with faster processors, bigger memories, and spooling hard disks have the advantage, because they can

pipeline the jobs; in other words, they can process the next job while a document is printing. The Xerox DocuPrint N40cn's multiple-job performance, which surpassed its best single-job performance, indicated that the printer pipelines its jobs very efficiently. In fact, that was the fastest output that any printer achieved on any of our tests. Among the departmental printers, the entries from Lexmark, HP, QMS, and IBM performed very well—all excelling beyond their single-job performance. In the small-workgroup category, the Lexmark Optra S 1855n, HP LaserJet 4050TN, and Xerox DocuPrint N17 topped the list of printers that handled multiple mixed-protocol jobs efficiently.

MICROSOFT POWERPOINT (6 PAGES)

The graphical PowerPoint presentation slides challenge each printer's rasterizing performance. The printers with efficient drivers, fast processors, and large memories have the advantage. The print engine has a minimal impact on this test.

The only notable standouts were the Canon ImageRunner 400E and the Lexmark Optra Se 3455n in the departmental category and the Lexmark Optra S 1855n among the workgroup printers.—Analysis written by S. Jae Yang

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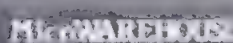
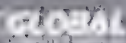
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ness graphics. But the printer performed poorly with halftones: Printouts suffered from noticeable banding in solid black areas, low contrast, and muddy shadow detail. Among its class, the 170N was about average on most of our speed tests.

There are other rough edges. We sometimes found the user manual's illustrations for clearing paper jams misleading. And the reset button on the 170N's rather clumsy control panel didn't work (it is supposed to clear the printer buffer of data and reinitialize the printer). The only way to abort a print job that has been sent to the 170N is to switch off the printer; in our experience this invariably produced a paper jam. But if they can put up with the 170N's quirks, budget-conscious users may find it an acceptable performer.—*John Gleidman*

Hitachi Koki DDS 32

32 ppm, 600 dpi, tabloid-size paper; basic configuration, \$4,095 list; tested configuration, \$6,560. Simi Valley, CA; 800-980-0374; www.hitachi-hkis.com.

● Even though the Hitachi Koki DDS 32 Digital Document Server's multifunction capabilities are not yet ready for prime time, the above-average print quality and respectable speed performance make it worth a look for groups of 10 to 50 people. And the DDS 32's \$4,095 list price includes dealer setup of the hardware and full installation and configuration of the printer on the user's network.

PrintWatch, the printer's network management tool, supports most administrative functions, such as monitoring consumables and reporting the location of paper jams in the print path. With the optional fax module (\$440 street), PrintWatch can automatically notify end users about excessive printer errors, upcoming periodic maintenance, and the status of toner and staple supplies. And though PrintWatch cannot track usage by an individual user, it can assign a user to up to 64 different printer configurations, which appear as distinct printers on client machines. These virtual printers can be given different priorities in the print queues and monitored for usage. The Windows NT 4.0 version of PrintWatch is not yet available, though the vendor promises it for later this year.

The DDS 32's multifunction capabilities are still evolving. Users currently

cannot fax a document stored on the DDS 32's hard disk, nor can they scan a document with the optional copier module (which we did not test) and then fax it. Hitachi Koki says this capability will be added later. Though our printing went off without a hitch, we would think twice about using the DDS 32 as a copier: The standalone finisher is easy to dislodge from the base, and even the slightest misalignment triggers a paper jam. In addition, we found it too easy to create paper jams during print runs with our test unit simply by lifting a just-printed page out of the finisher before it fell into the output tray.

The DDS 32 delivers sharp business graphics and gray-scale photos with good



The HP LaserJet 8100DN offers a 3,100-sheet capacity and top-notch print quality.

contrast and excellent detail in the shadows, though it scored slightly below average on our speed tests. —*JG*

HP LaserJet 2100TN, 4050TN, 5000GN, 8100DN

2100TN: 10 ppm, 1,200 dpi, legal-size paper; basic configuration, \$700 street; tested configuration, \$1,000. **4050TN:** 17 ppm, 1,200 dpi, legal-size paper; basic configuration, \$1,100; tested configuration, \$1,600. **5000GN:** 16 ppm, 1,200 dpi, tabloid-size paper; basic configuration, \$1,450; tested configuration, \$2,600. **8100DN:** 32 ppm, 1,200 dpi, tabloid-size paper; basic configuration, \$2,550; tested configuration, \$3,300. Palo Alto, CA; 800-752-0900; www.hp.com.



Elegant design, slick features, and competitive prices are the selling points for the new network printers from Hewlett-Packard Co. These four products cover the spectrum from small workgroups to large, departments. They increase print speeds over the previous generation and provide easier setup, advanced

remote printing, and unsurpassed management tools.

HP has long been known for easy installation and robust setup tools, and these new LaserJets maintain that tradition. Except in the high-end 8100DN, the accessory trays simply stack under the main unit, and internal add-ins slip into accessible slots. The network setup routine for all four models is virtually automatic: A driver wizard searches out new JetDirect network adapters, then walks you through the server configuration. If DHCP is enabled, the process takes less than 5 minutes. On the average, we had each product ready for network use in less than 15 minutes. New users can be set up remotely by installing drivers sent via e-mail. The only administrative software comparable to HP's is that of the Lexmark Optra line.

General management tasks can be performed either with the browser-based Web JetAdmin (locally or over the Internet via TCP/IP) or directly on the LAN with the standard JetAdmin. Both make it easy to set options, track usage, and control access.

The 2100TN is a compact printer that should be on the short list of any small-workgroup buyer. This unit is well suited for low-volume work environments, and it includes an instant-on fuser that reduces the first-page-out delay.

Print quality was very good for a low-cost laser. Large black areas were solid without streaking, gradients were smooth, and text was clean and sharp. Photos showed pleasing gray-scale rendering, and transparencies had good tonal range, with no crinkled edges or curling from excessive heat. The 2100TN has a rating of 10 ppm: Though HP insisted that it could perform with the 12-ppm printers, it was slower than them on most of our tests.

The LaserJet 4050TN is the network version of HP's new mainstay monochrome product. It has a 1,500-sheet maximum paper capacity in five bins (you can dedicate a bin to a special medium like transparencies), and it has a rated monthly duty cycle of 65,000 pages. The LED control panel has reasonably

clear options and settings.

Print quality is very good, with crisp text, a smooth matte finish in solid black areas, pleasing gray-scale tones, and smooth gradient fills. The unit does have problems handling PostScript 3 advanced gradient mesh features in a complex Adobe Illustrator file. Using the PostScript 3 setting returned an error and failed to properly render the page. Ideally, the printer should have recognized the failure and reverted back to PostScript Level 2 output. But transparencies reproduce very well. Given the range of features and overall performance, the 4050TN is a good choice for workgroups that don't require large paper sizes.

For more demanding workgroups, the 5000GN offers tabloid support and, optional duplexing (\$400 street). When the duplexer is installed, however, the network and parallel-port cable attachments are harder to access.

Print quality is virtually identical to the 4050TN's, but we noticed that the 5000GN's PostScript emulation did a better job handling the complex Illustrator drawing. Pure black areas were even more of a flat matte than with the 4050TN, and fine diagonal lines reproduced with no noticeable jaggedness. The printer finished near the head of the class in the 12- to 18-ppm category on all tests except the Microsoft PowerPoint test. The instant-on fuser had the first page out in only 13 seconds from a cold start. In sum, the 5000GN has all the right tools for a network workhorse.

The same elegance of design carries over to the 8100DN, with its 3,100-sheet capacity, 150,000-page-per-month duty cycle, 20,000-page-toner cartridge, 2GB hard disk, and duplexer unit. Although the unit does not follow the stackable-add-on design of the other HP printers tested here, it was easy enough to install items like the duplexer unit or additional RAM.

Our only disappointment with the 8100DN was another instance of failure while trying to handle the complex fills in our PostScript 3 Illustrator file. Text output was excellent, gray scales well rendered, and gradient fills smooth without noticeable banding. Solid expanses were even and free of build-up or banding.

With this lineup, HP is a winner.—JK



Using the IBM Network Printer Manager, you can administer the Infoprint 20 via the network or the Web.

IBM Infoprint 20, 32, 40

Infoprint 20: 20 ppm, 1,200 dpi, 13- x 20-inch paper; basic configuration, \$1,530 street; tested configuration, \$2,390.

Infoprint 32: 32 ppm, 1,200 dpi, ledger; basic configuration, \$2,500; tested configuration, \$3,350. **Infoprint 40:** 40 ppm, 1,200 dpi, ledger; basic configuration, \$2,930; tested configuration, \$3,590. IBM Printing Systems Co., Boulder, CO; 888-426-7746, www.printers.ibm.com.

● IBM's monochrome network printers are positioned a bit differently from most of their competition. Where most manufacturers include lots of features as standard equipment in their models, IBM takes more of an à la carte approach. Whether you choose the workgroup-size IBM Infoprint 20 or the larger, department-size IBM Infoprint 32 or Infoprint 40, you'll need to buy the extras you want—including the network interface card (\$530 street). (The missing network card makes sense when you consider that a large portion of IBM's clientele installs these printers to work on Token-Ring networks and not Ethernet.) Fortunately, you can add a variety of options, including extra paper bins (\$150) and a sorter/stapler (\$1,440). These printers are best suited for text applications.

All three models use IBM Network Printer Manager (NPM) administrative software and configuration tools. Setup for Windows NT was relatively easy using the NPM software, but for NetWare you have to use the NetWare printer management utilities, which are not as convenient, as they are not wizard-based. NPM can also be used to monitor third-party printers that comply with the MIB

standard (this is also true of Canon's NetSpot software). The software includes a special port monitor, for use on Windows NT installations, that extends the print job status and notification features. Although NPM allows you to view the status of each printer, including its alarm functions, and change printer properties such as the input tray, it is not as robust as HP's JetAdmin.

All three printers have IBM's Network Printer Manager for the Web, with embedded Web pages that any browser can access. This feature provides

access to printer status and configuration details. You can also password-protect the printer settings, though there is only one level of security available.

In general, all three printers are excellent at text and paper handling, but they have varying results in graphics print quality and speed. The Infoprint 20 was the weakest of the three on photographic images—even using the 1,200-dpi quality mode—with pronounced banding and artifacts in dark gray regions. The Infoprint 32 and 40 were much better on photographic images, but there was still some noticeable banding. The Infoprint 20 had some dropout and banding on large areas of solid black, where the two faster printers did a generally good job, with only some slight dropout in small regions.

In terms of speed, the printers performed on a par with other printers with similar speed ratings. The Infoprint 32 ran ahead of the pack on our Microsoft Word Text-Only test, with a page-per-minute result that topped some printers rated at 40 ppm. The Infoprint 20 was better than average in its category on the Mixed Simultaneous Jobs test. On the other hand, all three printers were noticeably slower than most of the competition on the Duplex Text and Graphics test. If print speed for multiple copies is important to your office, you can add an optional hard disk to any of the printers. This provides the ability to buffer the page images received from the print queue, so they do not have to be sent again for multiple copies.

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If your needs are simple and modest, the basic models may be all you need, and you can save a few dollars. As long as you keep in mind that all the options will add to the base price, the Infoprint models from IBM are competitive and attractive purchases for a medium-size workgroup or department.—*Alfred Poor*

Lexmark Optra K 1220n, Optra S 1855n, Optra Se 3455n

Optra K 1220n: 12 ppm, 600 dpi, legal-size paper; basic configuration, \$750 street; tested configuration, \$1,000. **Optra S 1855n:** 18 ppm, 1,200 dpi, legal-size paper; basic configuration, \$1,500; tested configuration, \$1,900. **Optra Se 3455n:** 34 ppm, 1,200 dpi, legal-size paper; basic configuration, \$2,300; tested configuration, \$2,650. Lexington, KY; 800-539-6275; www.lexmark.com.



Lexmark International's approach to the monochrome network printer market is to serve up a troika of printers, each slanted to a slightly different submarket, and each packed with an excellent combination of administrative tools, networking ability, basic print features, quality, and value.

While the Optras all deliver an excellent price/performance ratio, the Lexmark Optra S 1855n is an extraordinary value. For less than \$3,000 (\$2,280 street), you get duplex printing, 18-ppm speed, 1,200 dpi resolution, and 1,350-sheet input.

The top-of-the-line Lexmark Optra Se 3455n is aimed squarely at the upper reaches of the departmental market. This 34-ppm workhorse—with a 1,350-page capacity, which can be upgraded to 3,750 pages—came outfitted with an optional page-duplexing unit (\$280). Designed for workgroups, the 18-ppm 1855n has a 350-page capacity tray, upgradable to 3,350 pages, and came outfitted with a duplexer (\$280), and two extra 500-sheet drawers (\$250 each) for a tested capacity of 1,350 sheets. Down in the workgroup/small-office realm, the Lexmark Optra K 1220 is a more modest 12-ppm, 600-dpi printer that came only with its default 200-page input capacity (upgradable to 650 pages) and the standard MarkNet network adapter. This is a very strong line of printers, all of which did well in our testing.

Integrating a Lexmark printer into a network is a pleasure—on a par with



The Lexmark Optra Se 3455n kept pace with the 40-ppm units in our speed tests.

printers from the long-time standout Hewlett-Packard. Between the excellent administrative utility MarkVision, with its near-automatic NetWare installation, and the company's NetPNP utility, which combines with DHCP to automate Windows NT installation, virtually anyone can set up any one of these printers for network use. Unix users, particularly those in enterprise situations, are well accommodated with a flexible suite of management tools.

Physical installation is also a breeze: To integrate extra trays or duplexer units, simply stack them up and place the printer on the top. In addition to supporting multiple MarkNet or other cards, the printers can be upgraded to receive and print faxes.

Administrators will like the printers' built-in Web page, which contains administrative tools and status displays. Consumables management is also well thought out, as you can access information about any of the printer's replaceable elements and set up alerts for when supplies run low. Monitoring the Lexmark printer is exceptionally easy, thanks to MarkVision's ability to deliver on-screen alerts to administrators, a status display for users, and both SNMP and application-level compatibility for most network administration packages.

When it came to performance, the 3455n was exceptional. At times surpass-

ing the speed of 40-ppm printers, the unit ranked above the 32-ppm printers on all but one of our performance tests. The 1855n also did well, keeping pace with and occasionally surpassing other printers in the small-workgroup category. The 1220n performed as well as a 12-ppm printer could.

Paper handling on all three printers is excellent. Each unit automatically detects paper size, "paper low," and "paper out," as well as "full" and "nearly full" on the output tray. The trays themselves are designed so that if you overload a tray, the paper is harmlessly pushed out as you close the tray drawer. The 1855n and 3455n can also be outfitted with envelope feeders and three-drawer addressable output trays.

Quality was uniformly above average. While these printers didn't print as well as the top-rated Canon, HP or QMS, they delivered excellent business-quality text and graphics. Quality on the 1220n proved a pleasant surprise: With its interpolated 1,200-dpi-resolution algorithm (1,200 Image Quality), it came close to the true 1,200-dpi printers. We did have some trouble with scaling on our Windows NT PostScript Excel test. And although Lexmark did come up with a fix, that does underscore the continuing trouble we had with Windows NT PostScript drivers in general.—*David A. Harvey*

Minolta PageWorks 25

25 ppm, 600 dpi, tabloid-size paper; basic configuration, \$1,500 street; tested configuration, \$4,030. Mahwah, NJ; 888-264-6658; www.minoltaprinters.com.

● The Minolta PageWorks 25 gets strong marks for paper handling, quality, and speed, and it gets average marks for network setup and management. Our tested unit came equipped with three tabloid-size paper drawers totaling 1,250 sheets—the maximum input capacity is 3,750 pages—and a five-slot addressable mailbox (\$900 street).

While setting up the PageWorks isn't overly complicated, it does take a screwdriver and some patience to integrate the mailboxes and duplexing unit. Network setup also took some effort. Configuration under NetWare requires that you use NWAdmin to set up the printer man-

ually for duty under NDS. You also have to use a supplied MAP utility or the printer's Web page to set up the printer to recognize newly created NDS objects. The same utility can set the printer's TCP/IP address.

Our Windows NT server setup proceeded a bit more smoothly: Minolta has a handy utility that walks you through creating a shared port for the printer and automatically loads drivers for all the platforms that will attach to the printer under Windows NT. For printer administration, the PageWorks uses the Web-based PageScope, which can manage multiple Minolta printers. Although PageScope has everything from control over network functions to an emulation of the front panel, it doesn't have any information about the state of printer consumables.

The PageWorks performed quite well on our speed tests, easily besting the 24-ppm Toshiba printer and outperforming several 32-ppm models. The quality is good, especially for a 600-dpi printer. When we used the recommended bright-white paper and 1,200-dpi interpolation, it was very close to that of true 1,200-dpi printers, with crisp text and little banding.—*DAH*

NEC SuperScript 1260N

12 ppm, 600 dpi, legal-size paper; basic configuration (tested), \$880 street (after \$100 rebate). Itasca, IL; 800-632-4636; www.nectech.com.

● In view of its price and print speed, the NEC SuperScript 1260N is obviously targeted for a workgroup or small office. NEC keeps this in mind; network setup is simple enough that you don't need to be a network expert to set up or maintain the printer.

The manual gives step-by-step instructions for NetWare, Windows NT, and other environments—including a peer-to-peer Windows network—without assuming that you already know how to use NetWare's NWAdmin. Although there is not an automated setup like HP's or Lexmark's, the manual makes the job hassle-free.

Remote management is essentially identical using either NEC's Management Access Program or the printer's built-in Web pages. Either way, the features are limited; you can't, for example, get a

report on consumables. Be aware the peer-to-peer capabilities let you print over the Internet, though not as easily as with other solutions like HP's JetSend. NEC has not decided whether it will support IPP on the 1260N.

Image quality is easily good enough for business documents, from letters to newsletters to Web pages. On our tests, edges on graphics and text were suitably crisp, with 6-point text easily readable. Yet the characters were a bit gray, which can tire the eyes on long documents. Graphic fills were solid despite visible dithering; gradients changed gradually, and photos were near photo-quality



The QMS 3260EX is a solid choice for departmental printing.

except for a noticeable ghost image in our full-page photo.

The driver offers semi-automated duplexing, which is quite appropriate for a small office. The printer prints every other page, then gives instructions for reinserting the paper. In our labs, the 12 ppm 1260N was slightly slower than Lexmark's 12-ppm unit on all but one test. On our PowerPoint test, it was 75 percent faster.—*M. David Stone*

QMS 3260EX, 4032

3260EX: 32 ppm, 1,200 dpi, tabloid-size paper; basic configuration, \$2,800 street; tested configuration, \$3,250. 4032: 40 ppm, 1,200 dpi, tabloid-size paper; basic configuration, \$3,200; tested configuration, \$3,700. Mobile, AL; 800-523-2696; www.qms.com.

● The QMS 3260EX and 4032 are built around essentially the same engine running at different speeds. So it's not surprising that the two are virtually identical in all other respects—from their straightforward physical and network setup and administration to their paper-

handling features and high-quality output. Either one is a wise choice for departmental use; the choice depends only on how much raw speed you need and how many pages you print. (The 3260EX is rated at 150,000 pages per month, the 4032 at 200,000).

Network setup for both Windows NT and NetWare is straightforward if you are network-savvy. Unfortunately, you won't find the information you need in the printed setup manual. A Windows NT administrator could probably set up the printer without help, but without a call to QMS technical support, you could overlook the preferred approach of installing a QMS Print Monitor port. The Getting Started manual also assumes you know how to use NWAdmin to set up a printer for NetWare.

QMS allows three choices for remote management: CrownAdmin 3 software, telnet, and the built-in CrownView Web pages. Each offers different capabilities: CrownView will let you change a small subset of printer settings, while CrownAdmin and telnet will let you change any setting. These tools are reasonably capable, but there are some gaps. Only CrownAdmin 3 has built-in password protection.

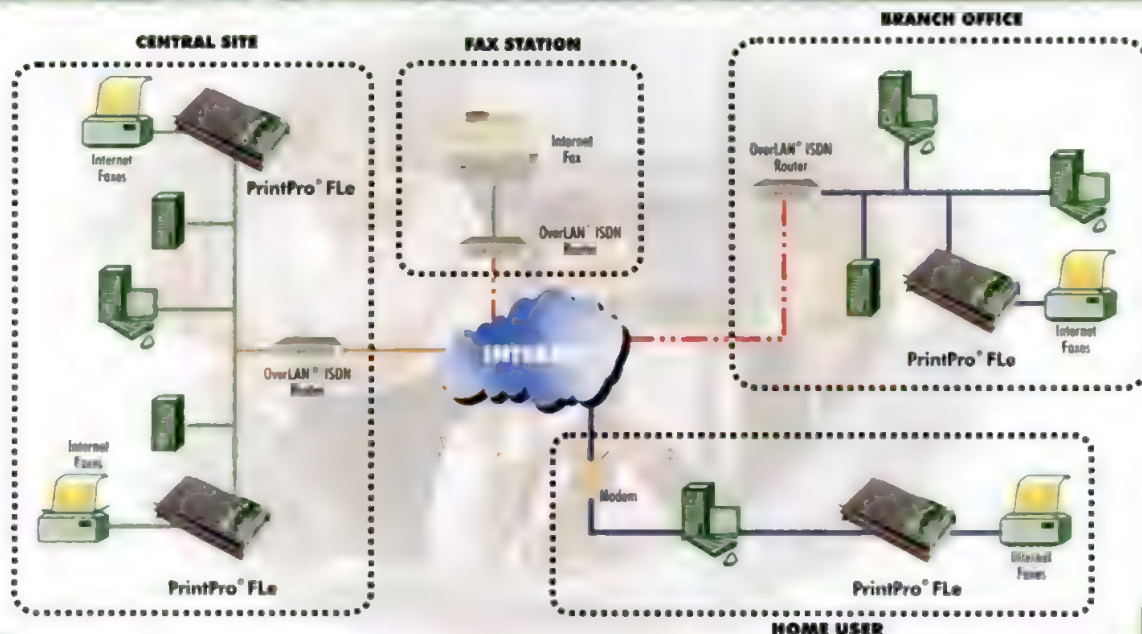
The others need a \$99 security key, which also adds password protection for changes at the front panel.

There is currently no Internet printing support, but QMS plans full support for IPP for both printers under Windows 2000. It also plans to add cross-platform Internet printing to CrownView in the near future.

The SC-100 scanner (\$400 street) can plug into either printer's parallel port. The scanner lets you use the printer as a copier, and it includes a copier-like front panel. We tested it with the 3260EX and found that the combination can indeed serve as a handy copier, though it lacks the automatic document feeder that you'd want in a departmental copier.

In our labs, both printers offered essentially identical image quality, with excellent output for monochrome business documents. Edges on graphics and text were crisp and clean, with text easily readable at 6-point size. Graphics fills were solid and even, and gradient fills changed gradually,

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SUMMARY OF FEATURES

Network Printers

■ YES □ NO

Products listed in alphabetical order

	Brother HL1660e	Brother HL2060	Canon imageClass 4000	Canon imageRunner 400E	Compaq LN16	Compaq LN32	Genicom microLaser 170N	Hitachi Koki DDS 32
Rated engine speed (ppm)	17	21	32	40	17	32	17	32
Maximum paper size	Legal	Legal	Tabloid	Tabloid	Legal	Tabloid	Legal	Tabloid
Street price, basic configuration	\$900	\$1,100	\$2,450	\$17,200	\$1,250	\$2,650	\$1,200	\$4,095 list
Street price, tested configuration	\$1,980	\$3,410	\$2,750	\$24,910	\$2,180	\$6,080	\$1,200	\$4,095 list
Ethernet adapter (list price)	\$300	\$400	\$549	Included	Included	Included	Included	\$625
Minimum/maximum RAM	8MB / 72MB	8MB / 72MB	8MB / 40MB	64MB / 96MB	12MB / 68MB	32MB / 96MB	12MB / 68MB	48MB / 128MB
High-capacity paper cassette (sheets/price)	500 / \$330	500 / \$330	2,000 / \$1,199	3,500 / \$2,239	None	2,500 / \$958	500 / \$395	2,500 / \$1,345
Duplexer	\$550	\$550	\$595	Included	\$400	\$400	\$475	\$495
Sorter	None	\$700	\$1,059	\$3,750	None	\$1,528	None	\$2,055
Stapler/stacker	None	None	\$1,849	\$3,750	None	Included with sorter	None	Included with sorter
Copy station	None	None	None	Included	None	None	None	\$8,195
Claimed maximum resolution (dpi)	1,200 x 600	1,200 x 1,200	600 x 600	1,200 x 600	2,400 x 600	1,200	600	600
Processor speed	100 MHz	100 MHz	100 MHz	200 MHz	125 MHz	133 MHz	125 MHz	50 MHz
Highest PCL level supported	PCL 6	PCL 6	PCL 6	PCL 5e	PCL 6	PCL 5	PCL 6	PCL 5e
Highest PostScript level supported	Level 2	Level 2	Level 3	Level 3	Level 2	Level 3	Level 2	Level 2
PostScript emulation	Brother	Brother	Adobe	Adobe	Pipeline	Adobe	Pipeline	Adobe
Supports NetWare 4.x / 5.0	■ ■	■ ■	■ □	■ ■	■ ■	■ ■	□ ■	■ □
Supports Windows NT / Linux	■ ■	■ ■	■ □	■ □	■ □	■ □	■ □	■ □
Print management utility included	BR-Admin	BR-Admin	NetSpot	NetSpot	Remote Control Software	Remote Control Software	Remote Control Software	PrintWatch
Utility can control other brands of printers	■	■	□	■	□	□	□	□
Web-based management utility included	BR-Admin	BR-Admin	None	Web NetSpot	None	None	None	None
Remote messages								
Paper jam/Paper out/Paper low	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■
Toner out/Toner low/Usage tracking	■ ■ □	■ ■ ■	□ ■ □	■ ■ □	■ □ □	■ □ □	■ □ □	■ ■ □
End-user applet driver								
Windows 95 / 98 / NT	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■
OS/2 / Mac OS	□ □	□ □	□ ■	□ ■	□ ■	□ ■	□ ■	■ ■
Graphical depiction of printer status	■	■	■	■	□	□	□	■
Thumbnail/booklet/watermark printing	■ ■ ■	■ ■ □	■ □ ■	■ ■ ■	■ □ □	■ □ □	■ □ □	■ ■ ■
Job hold/preview/reprint	□ □ ■	□ □ ■	□ □ □	■ ■ □	□ □ □	□ □ □	□ □ □	□ □ □
Rated duty cycle (pages per month)	80,000	115,000	150,000	150,000	35,000	150,000	35,000	150,000
Number of standard paper inputs	2	2	3	2	1	2	2	3
Total standard capacity (pages, input/output)	650 / 250	650 / 500	3,100 / 2,500	1,200 / 300	550 / 250	1,000 / 500	550 / 250	1,050 / 500
Prints on envelopes	■	■	■	□	■	■	■	■
Claimed cost per page (5 percent coverage)	1.3 cents	1.3 cents	2 cents	2 cents	1.5 cents	1.2 cents	1.5 cents	1.4 cents
Supports simultaneously active ports	■	■	■	■	■	■	■	■
Supports more than one installed NIC	□	□	□	■	■	■	□	□
Toll-free technical support	■	■	■	■	■	■	□	■
Technical-support hours (eastern time)	9:00-7:15 M-F	9:00-7:15 M-F	8:00-8:00 M-F	9:00-6:00 M-F	24 hours, 7 days	24 hours, 7 days	8:00-7:00 M-F	9:00-8:00 M-F
Warranty (parts and labor)	1 year	1 year	1 year	90 days	1 year	1 year	1 year	90 days

as they should. The full-page photos showed vertical dark bars—at virtually the same place for both printers—and also some horizontal lines, but they were otherwise near photo-quality.

The feature that differentiates the two printers is speed. On our tests, the 4032 was consistently among the fastest printers for each test, as is appropriate for the 40-ppm rating. The 3260EX was competitive with other 32-ppm printers, with acceptable ratings on all speed tests.

Either printer will fit nicely into a departmental slot.—MDS

Tektronix Phaser 740L

16 ppm, 1,200 dpi, legal-size paper; basic configuration, \$1,500 street; tested configuration, \$1,690. Wilsonville, OR; 800-835-6100; www.tektronix.com.

● At 16 ppm and with limited paper handling in the basic model, the Tektronix Phaser 740L is best for relatively small workgroups. It is on a par with other printers in its category, and its print qual-

ity and network management features don't disappoint. What sets it apart from the pack is a low-cost upgrade path to full color printing.

Network installation and management are simple, as you can set up Windows NT or NetWare configurations right from workstations. The software even supports local spooling on the client under Windows NT. The PhaserLink software embedded in the printer's ROM—accessible using any browser—makes it easy to

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check job status or change the printer configuration. The separate PhaserShare Admin software can be used to manage NetWare installations (and will work with Windows NT as well). One of the few limitations is that there is only one level of password protection on the printer configuration. The printer is all set for remote printing, and it even has a facility for e-mail-based printing, so you can print behind network firewalls.

The print quality is excellent, especial-

ly on high-quality paper. Halftones look nearly photographic, with only faint banding evident in some dark gray tones. Text and line graphics are razor-sharp. The speed is below average compared to other 16- to 17-ppm machines. The big story is the upgrade path. For just \$550, you can pop out a protective cover, slide in magenta, yellow, and cyan toner cartridges, and have a full-color 5-ppm laser printer that still is rated at 16 ppm for black-and-white jobs.

The 740L may cost a little more than some of its competitors, but it's an excellent choice. If you think you may need or want color printing in the near future but don't want it now, the 740L is your only choice.—AP

Toshiba DP2460

24 ppm, 600 dpi, tabloid-size paper; digital copier/printer, basic configuration (tested), \$7,975 list. Irvine, CA; 714-583-3805; www.toshiba.com.

● As printer manufacturers such as HP

SUMMARY OF FEATURES

See www.pcmag.com for interactive views

Ends

Network Printers

■ YES □ NO

Products listed in alphabetical order

	Minolta Page-Works 25	NEC Super-Script 1260N	QMS 3260EX	QMS 4032	Tektronix Phaser 740L	Toshiba DP2460	Xanté Accel-A-Writer 3DN	Xerox Docu-Print N17	Xerox Docu-Print N40cn
Rated engine speed (ppm)	25	12	32	40	16	24	20	17	40
Maximum paper size	Tabloid	Legal	Tabloid	Tabloid	Legal	Tabloid	Tabloid	Tabloid	Tabloid
Street price, basic configuration	\$1,150	\$880	\$2,800	\$3,200	\$1,500	\$7,975	\$1,850	\$1,250	\$3,400
Street price, tested configuration	\$4,030	\$880	\$3,250	\$3,700	\$1,690	\$7,970	\$3,600	\$1,500	\$5,050
Ethernet adapter (list price)	\$296	Included	Included	Included	Included	\$199	Included	Included	Included
Minimum/maximum RAM	8MB / 104MB	2MB / 16MB	16MB / 384MB	16MB / 384MB	16MB / 256MB	64MB / 64MB	32MB / 256MB	16MB / 104MB	24MB / 128MB
High-capacity paper cassette (sheets/price)	2,500 / \$989	500 / \$199	2,500 / \$199	2,500 / \$199	Included with duplexer	1,500 / \$934	2,000 / \$1,295	500 / \$220; 2,000 / \$1,060	2,500 / \$1,190
Duplexer	\$359	None	\$549	\$549	\$695	None	Included	\$295	\$550
Sorter	\$900	None	\$1,499	\$1,499	None	None	None	\$375	\$1,350
Stapler/stacker	None	None	Included with sorter	Included with sorter	None	Included with sorter	None	None	\$1,970
Copy station	None	None	\$399	\$399	None	None	None	None	None
Claimed maximum resolution (dpi)	1,200 x 600	600	1,200	1,200	1,200	600	1,200	600 x 1,200	600
Processor speed	90 MHz	60 MHz	150 MHz	150 MHz	133 MHz	330 MHz	133 MHz	66 MHz	66 MHz
Highest PCL level supported	PCL 6	PCL 4	PCL 5e/GL2	PCL 5e/GL2	PCL 5C	PCL 5e	None	PCL 5e	PCL 5e
Highest PostScript level supported	Level 3 (\$269)	Level 3 (\$99)	Level 2	Level 2	Level 3	Level 2 (\$299)	Level 3	Level 3	Level 3
PostScript emulation	Adobe	Adobe	Adobe	Adobe	Adobe	Pacific Semiconductor	Adobe	Adobe	Adobe
Supports NetWare 4.x / 5.0	■ □	■ □	■ ■	■ ■	■ ■	■ □	■ ■	■ ■	■ ■
Supports Windows NT / Linux	■ □	■ □	■ □	■ □	■ ■	■ □	■ □	■ □	■ □
Print management utility included	Minolta PageScope	Management Access Program	Crown Admin3	Crown Admin3	PhaserLink	SC-Admin	Command Center	CentreWare DP	CentreWare DP
Utility can control other brands of printers	□	□	■	■	□	□	□	■	■
Web-based management utility included	Minolta PageScope	Management Access Program	CrownView	CrownView	PhaserLink	None	None	CentreWare Internet Services	CentreWare Internet Services
Remote messages:									
Paper jam/Paper out/Paper low	■ ■ ■	■ ■ □	■ ■ ■	■ ■ ■	■ ■ □	■ ■ □	■ ■ ■	■ ■ ■	■ ■ ■
Toner out/Toner low/Usage tracking	■ ■ □	■ ■ □	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ □	■ ■ □	■ ■ □	■ ■ □
End-user applet driver:									
Windows 95 / 98 / NT	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	□ □ □	■ ■ ■	■ ■ ■
OS/2 / Mac OS	□ □	□ ■	■ ■	■ ■	□ □	□ □	□ □	□ □	□ □
Graphical depiction of printer status	■	■	■	■	□	■	□	■	■
Thumbnail/booklet/watermark printing	■ □ ■	■ ■ ■	■ □ □	■ □ □	■ □ ■	■ ■ ■	□ □ □	■ ■ ■	■ ■ ■
Job hold/preview/reprint	□ □ □	□ □ □	■ ■ ■	■ ■ ■	□ □ □	■ □ □	□ □ □	■ □ □	■ □ □
Rated duty cycle (pages per month)	100,000	20,000	150,000	150,000	100,000	75,000	65,000	65,000	200,000
Number of standard paper inputs	2	3	2	2	2	3	3	2	3
Total standard capacity (pages, input/output)	750 / 500	830 / 250	550 / 500	550 / 500	350 / 500	4,500 / 1,495	1,150 / 500	350 / 250	1,050 / 700
Prints on envelopes	■	■	■	■	■	□	■	■	■
Claimed cost per page (5 percent coverage)	1.5 cents	1.8 cents	1 cent	1 cent	2.1 cents	0.7 cents	1.7 cents	1 cent	1.4 cents
Supports simultaneously active ports	■	■	■	■	■	□	■	■	■
Supports more than one installed NIC	□	□	■	■	□	□	□	□	■
Toll-free technical support	■	■	■	■	■	■	■	■	■
Technical-support hours (eastern time)	24 hours, 7 days	8:00-8:00 M-F	8:00-6:00 M-F	6:00-6:00 M-F	9:00-8:00, M-F	9:00-8:00, M-F	8:00-8:00 M-Th, 8:00-7:00 F	9:00-6:00 M-F	9:00-6:00 M-F
Warranty (parts and labor)	1 year	1 year	1 year	1 year	1 year	90 days	1 year	1 year	1 year

and QMS push into office copier territory with models that scan, collate, and staple, office product companies are pushing back with network-enabled digital copiers. That's the impetus behind the Toshiba DP2460. If you're looking for a copier that can augment other printers on your network, this model is worth considering—especially if the \$17,200 Canon imageRunner 400E is out of your range. We found that the Toshiba, however, was too temperamental to serve as

a primary network printer.

The DP2460 looks and behaves like a departmental office copier, with an intuitive LCD panel to set copy options (enlarge, reduce, collate, staple, and so on). Network printing functionality is provided via the \$200 SC-1 network controller. Hardware setup is included in the price; the manual warns of dire consequences if anyone other than a Toshiba technician switches on the SC-1 for the first time.

Network setup requires a good deal of knowledge and is not as automatic as routines from HP and others. For smaller companies without IS departments, the Toshiba tech will get the unit hooked up to the network for a "nominal fee." Toshiba's administration utility, SC-Admin, is adequate but not as robust as those from HP, Lexmark, and QMS. For example, you can't see non-Toshiba units on the network or monitor consumables, but you can access various

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paper sources. And the utility does let you set copier parameters remotely, such as when the machine should go into sleep mode.

Once up and running, the DP2460 acted more like a copier than a printer. We experienced frequent paper jams, and the manual's explanations of how to clear jams were sometimes vague.

Print speed was another sticking point. On most tests, the 24-ppm engine was outpaced even by the 12-ppm lasers we reviewed because of slow first-page-out latency. On the plus side, output quality for both prints and copies was excellent. The DP2460 is a fine office copier, and the network connectivity means that it can serve for the occasional print job.—JG

Xanté Accel-A-Writer 3DN

20 ppm, 1,200 dpi, 13- x 18.5-inch paper; basic configuration, \$1,850 street; tested configuration, \$3,600. Mobile, AL; 800-926-8839; www.xante.com.

● With its lineage set squarely in the world of high-end printing and typesetting, the Xanté Accel-A-Writer 3DN can

quickly be upgraded to support professional publishing and proofing options like 2,400-dpi resolution, printing directly to film, and Xanté's proprietary color calibration, which accepts densitometer data. Unfortunately, average performance and quality, coupled with a lack of remote management, poor administrative tools, and difficult network setup, make this printer suitable only for those who need high-end publishing features.

There's nothing accelerated about setting up the Accel-A-Writer. You can't perform any initial setup over a network; instead, you have to set up a parallel or serial connection to use the supplied Xanté Command Center—as rudimentary a set of management tools as we've seen. The interface is vintage Windows 3.1, and the tools offer minimal functionality: They can set the IP address and NetWare server, get printer status, calibrate printer dimensions and gamma, and send a PostScript file, among other options. NetWare support is particularly bleak. The printer can connect only in Bindery mode, and to do this, you must use Nov-

ell's Pconsole. The only bright spot for NetWare users is support for up to six NetWare servers. Because Command Center requires a direct connection to the printer, and because the printer has no Web page, there's no option for remote management.

Performance ranged from average to slightly above average in its category on the speed tests. We were surprised that print quality was just average—with none of the sharpness we had expected in text and graphics. Apparently, without the high-end publishing upgrades, the Accel-A-Writer is just your average printer.—DAH

Xerox DocuPrint N17, N40cn

N17: 17 ppm, 600 x 1,200 dpi, legal-size paper; basic configuration, \$1,250 street; tested configuration, \$1,500.

N40cn: 40 ppm, 600 dpi, 11- x 17-inch paper; basic configuration, \$3,400; tested configuration, \$5,080. Rochester, NY; 800-349-3769; www.xerox.networkprinters.com.

● Xerox Corp. offers two network lasers that provide solid performance and value. The Xerox DocuPrint N17 is intended for small workgroups, and the

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HARDWARE

Network Printers

DocuPrint N40cn, with its ledger-size paper capacity, is for larger departments. Both offer good network management and print quality, but the paper-handling options and outstanding speed of the N40cn make it more attractive.

Both printers are easy to install and configure, as they share the same CentreWare Internet Services software, an embedded Web site in the printer ROM, accessible by any browser. The CentreWare DP software works with both NetWare and Windows NT, and the PrinterMap utility works with any SNMP-compatible printer. The setup programs automatically create and configure print queues for both Windows NT and NetWare, and they allow you to monitor supplies, including toner and fuser.

Two weak areas for both printers are remote management and Internet printing. At test time, these were not yet available, though the software is expected to ship before this review goes to print. You can password-protect the printer and its configuration, but there's only one level of access. And although



Print speed and paper handling are two assets of the Xerox DocuPrint N40cn.

the PrinterMap software can monitor the status of compatible third-party printers, it can't manage them.

The N17 has limited options for paper handling; it can accommodate up to 2,000

letter- or legal-size sheets. In our labs, it printed sharp text and line graphics, with large areas of black appearing smooth and solid. Darker shades of gray did show some signs of horizontal banding, however. On our speed tests, it was on a par with competitors in its category though it was the slowest on duplex prints.

The N40cn has a number of additional paper bins, which can bring its total capacity up to 3,500 sheets. During PC Magazine Labs' tests, the N40cn's text output was as good as that of its sibling, and it performed better on halftones, with much less banding. It ranked first in the entire roundup on several of our performance tests—including Text-Only and Mixed Simultaneous Jobs. But like the N17, it was significantly slower on duplex prints.

Each of these printers can accommodate a collator/stapler (\$1,970) and a ten-slot mailbox sorter (\$1,350). Once Xerox adds remote management and Internet printing capabilities, the DocuPrints may well become top-notch contenders.—AP **PC**

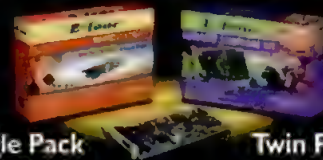
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SOLUTIONS

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Easy Web Animations



GIF files offer a simple way to dazzle visitors to your Web site with animations. Here's how you can create one of your own.

By William Robert Stanek

Notice anything different about the Web lately? Everywhere you look, things are moving, flashing, and changing. It's like watching the birth of multimedia all over again, but not on CD-ROMS. These animations are not limited to giant software company's Web sites: They're also on the home pages of small businesses and individuals. And here we'll show you how to create one for yours.

This kind of animation has little to do with buzzword technologies like Java, ActiveX, or Flash, but it has everything to do with an otherwise ordinary technology for formatting images: GIF. With GIF, you don't need controls, plug-ins, or scripts to create animations. All you need are plain old graphics. Why bother with technologies that are compatible with only one browser when there's a simple, cross-platform alternative?

AN ANIMATION TOOLKIT

Before you can create GIF animations, you'll need a toolkit consisting of three programs: a graphics editor, an image optimizer, and an animator. For our step-by-step demonstration, we'll use the Image Composer program included with Microsoft FrontPage, Ulead's GIF Animator, and Adobe ImageReady, but the same procedures will apply with whatever software you decide to use. In the graphics editor, you'll create the basic images for the animation. Good choices include Adobe Photoshop, CorelDraw8 (both *PC Magazine* Editors' Choices), and Microsoft PhotoDraw 2000.

For any component in your animation toolkit, you can also go with low-cost shareware products, such as Jasc's image editor Paint Shop Pro. A good place to look for shareware for your toolkit components is www.pcmag.com/downloads/swlib/swcol.webauth.html.

Without an optimization program, you'll end up with large GIF files that are slow to download and sure to frustrate your site's visitors. One powerful product of this type is Equilibrium's DeBabelizer, which lets you optimize color palettes, reduce image byte size, and adjust individual pixels. The better the optimizer, the more compact your images will be.

As with image editors, you won't need to shell out hundreds of dollars for a professional optimization utility. Most animation utilities have top-notch optimization features built in. Until fairly recently, most GIF animation utilities weren't powerful or versatile enough to create the polished animations you see today. But that all changed when mainstream developers discovered how powerful

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What to do if your Recycle Bin is being bypassed; when text on screen blurs sporadically; filling in scanned forms in Word 97; calculations involving multiple Excel worksheets; retain leading zeros in Access fields. *Page 226.*

UTILITIES



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INTERNET BUILDER



Images used for the Web have not kept pace with other aspects of Web technology, but improvements are emerging, in the form of PNG files and vector graphics formats. *Page 240.*

PC TECH



Linux 2.2 rivals Windows NT 4, boasting a comprehensive complement of features, capabilities, and compatibilities—even running on x86-based machines. What's more, it's free. Linux and Apache remain an attractive choice for Web servers compared with Windows NT. *Page 247.*

More on the Web:

You'll find all of the articles, examples, and code files in this section at *PC Tech* online.

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and versatile GIF animation really is—and where there's a demand, solutions come. Solutions include Ulead's GIF Animator and Gamani Productions' shareware animator GIF Movie Gear.

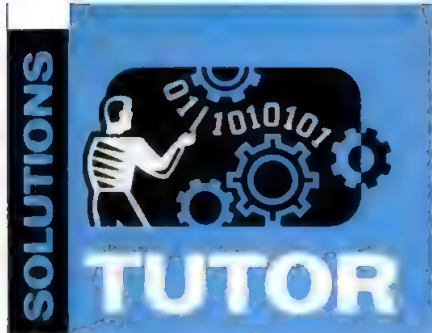
ALL IN ONE

As an alternative to using a separate graphics editor, optimizer, and animator, there are also all-in-one, Web-centric graphics applications designed to do it all, such as Adobe ImageReady and Macromedia Fireworks—a *PC Magazine* Editors' Choice ("Web Graphics," November 3, 1998).

ImageReady has an interface similar to Adobe Photoshop's. While the interface is easy to use, the GIF animation features are somewhat lacking and difficult to manipulate. By contrast, Macromedia Fireworks has terrific animation and optimization features. You can even optimize most animations in one step. An alternative to ImageReady and Fireworks is Totally Hip Software's WebPainter.

ANIMATION 101

GIF animation techniques have roots that go back decades—all the way to the earliest days of cel animation and film classics like *Bambi* and *Snow White*. In cel animation, you create



the illusion of motion by displaying a series of images, each appearing on-screen for a fraction of a second.

Similarly, when you create GIF animation, you use a series of images that are drawn out on cels (or frames). Planning how these cels come together is the first step. Questions to ask yourself at this stage are: What do you want to animate, what frame size is best, and how many frames do you need? You can animate just about any image; one example is your company's logo or mascot for your Web site. You also should be careful not to overdo it with an annoying excess of unnecessary animations on your Web page.

Generally, each frame should be the same size, so you can move objects around within a consistently sized window. If you add the same background to the frames, you can move objects around a consistent setting as well, which is how cel animation is done in classic cartoons. For example, if you are going to create a bouncing ball, create a room as the background for the ball to bounce in. The

background doesn't have to be fancy.

Now that you have an animation in mind, you need to plan out its frames. Again, animation is accomplished by using slightly different images from frame to frame. To make a ball bounce, you move its position in each frame. In our demonstration, six frames are used. Frame 1 shows a room. Frames 2 through 5 show a ball moving toward the floor. Frame 6 shows the ball hitting the floor. If you reverse the order of frames 2 through 5 and add them to the end of the animation the ball will move down and up, giving the animation a back and forth motion that can be repeated.

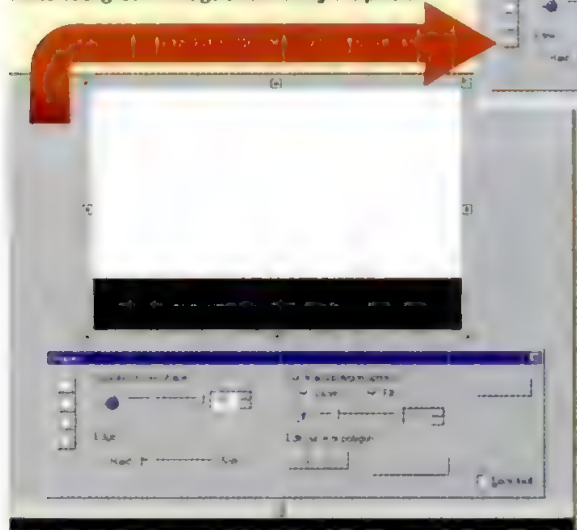
As you see, the illusion of motion is easy to create. Still, the animation is a bit rough. To smooth it out, you can reduce the amount of movement from frame to frame and adjust the timing of the frame display accordingly.

As you reduce movement from frame to frame, you'll need to add frames to get the complete range of motion. So instead of six frames it may take ten frames for the ball to reach the floor.

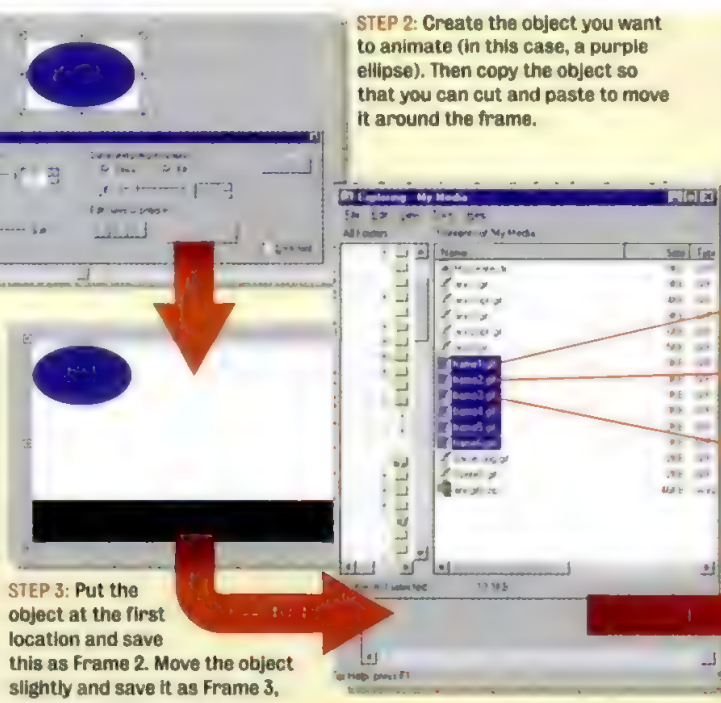
Frame timing is equally important. Each frame is displayed for a specific duration, which is usually set in hundredths of a second. Short display times speed movements. Long display times slow things down. In the

1. Creating the Animation

Equipped with a software toolkit and an animation strategy, you're now ready to begin creating your first animation. We'll use Image Composer and GIF Animator to demonstrate the process. Start with a white background image sized 420 by 275 pixels.



STEP 1: Add a surface for the animation by drawing a 420- by 80-pixel black rectangle, which will be the floor. Then save this as Frame 1.



STEP 2: Create the object you want to animate (in this case, a purple ellipse). Then copy the object so that you can cut and paste to move it around the frame.

STEP 3: Put the object at the first location and save this as Frame 2. Move the object slightly and save it as Frame 3, and so on to Frame 6. If you save the files with sequential filenames, they'll be easier to track.

STEP 4: Add the frames to an animation sequence. Select the frames in Windows Explorer and

example, we use 20 hundredths of a second as the frame interval, which is an average-space display time.

Keep in mind that the byte size of an animation is directly related to frame size, image complexity, and the number of frames used. A large frame size means a large byte size. Colors, complex images, and backgrounds eat up bytes too. Additionally, the byte size is essentially multiplied for each frame you add. If each frame is 3K and you have ten frames, a nonoptimized animation is a whopping 30K. Because of this, you should always ask yourself how many frames you really need to make the animation work and whether you've included any unnecessary frames.

OPTIMIZING THE ANIMATION

If you created the animation using Image Composer and GIF Animator, the resultant animation should be about 9K—rather large for such a simple animation. Imagine what would happen if you created a complex animation with lots of colors and images. The file size could quickly balloon to 60K. To reduce your file's size, you need to optimize the animation.

Start with the animation's colors. GIF images can have up to 256 colors, which usually



are stored in a global palette. It's possible, however, for individual frames in an animation to have local palettes as well. Rather than using these local palettes, you should merge them into a single global palette.

Most animation utilities have a function for creating an optimized global palette. For example, in Adobe ImageReady, you simply select a palette optimization method and then apply this to all the frames in the animation.

After this, you can reduce the number of

colors in the global palette or select the specific number of colors you want to use, say 64 or 128. If you find that the optimized global palette distorts your colors, try to reduce the number of colors used in the local palettes first. Do this by merging similar colors and deleting unused colors before trying to create the global palette.

The sample animation uses only three colors, which makes optimization easy. Open the animation in the optimizer (we'll use ImageReady in this example). Use the eye dropper tool to select the white background. This highlights the color in the global palette and lets you lock it to prevent deletion. Repeat this step for blue and black. Next, select all the other colors in the palette and delete

2. Display Settings

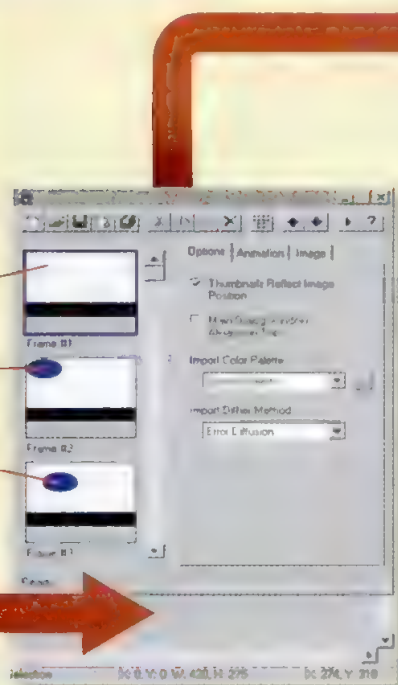
Now that you've set up the animation frames, you'll need to set the time delay and display method for each frame. Display methods specify how transitions are handled. GIF Animator supports four display methods (which it calls undraw methods): Undefined, Leave, Restore Background, and Restore Previous.

Most GIF animation utilities support these four methods. *Undefined* tells your browser not to use a transition. *Leave* instructs your browser to leave the previous frame as the next frame is drawn. *Restore Background* has the browser redraw the original background as the current frame is drawn. *Restore Previous* tells it to redraw the previous frame as the current frame is drawn. To set the time delay and display method for each frame, follow these steps:

STEP 5: Select Frame 1, then set its duration to 20 hundredths of a second. In GIF Animator, you do this by clicking on the frame, then setting the value of the Image tab's Duration field to 20.

STEP 6: Next, select the transition method for the frame. For this example, use Leave in the first example and Restore to Background in the second example. Set the time delay and display method for each of the other frames.

STEP 7: Set the looping preference for the animation. This specifies whether the animation sequence should repeat, and if so, how many times. Select the Looping checkbox, then set the number of loops using Repeat Count or Repeat Forever. Beware: Animations that repeat forever can become annoying, so it's usually better to set a specific repeat count, such as three.



drag the files into GIF Animator. That program will import the images as Frames 1 to 6.

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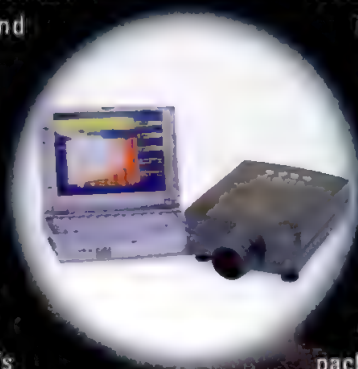
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them. You should now have a three-color global palette. Save the optimized image and you should find that the file size has shrunk considerably. On my system the resultant file was only 3K.

Another technique for reducing file size is optimizing individual frames. With frame optimization, the first frame becomes the anchor

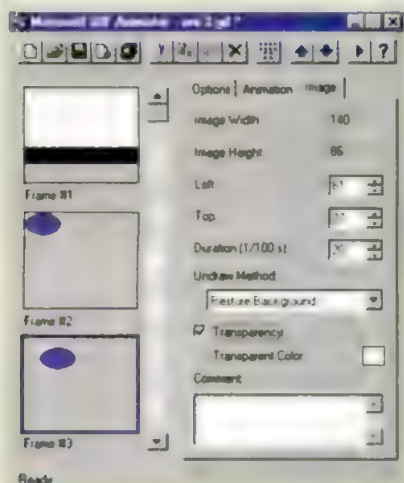


Figure 1: In frame optimization, you crop out the moving object and place it in a different location in each subsequent frame.



point. This is the only frame saved in its entirety. All other frames are saved only in terms of frame-to-frame changes. To do this, you crop out sections of the frame, keeping only the part of the frame that changes and discarding the other parts. You then position the frame-to-frame changes individually by setting the x,y-coordinates for the top-left corner of the cropped image (see Figure 1).

AUTOMATED OPTIMIZATION

The best animation utilities offer automated frame optimization. The three most common methods are *minimum bounding rectangle*, *lzw*, and *frame differencing*. Minimum bounding rectangle saves the difference between the frames as rectangular areas. In our sample, this method would create a rectangle containing the blue ball and a bit of the white background. LZW optimization looks at pixel patterns to find the minimum area necessary to save. In our sample, this method would find the repeated pattern, which in this case is the

blue ball. Frame differencing takes a pixel-by-pixel look at how the frames are different from one another. The optimization technique then saves only the pixels that change.

You can also optimize the frames of your animation manually. For the sample, we used Image Composer and GIF Animator. In Image Composer, select the blue ball and save it as a separate image. Next, start a new animation in GIF Animator. Use Frame 1 of the original animation and then create five additional frames using the ball. For Frame 2, position the ball at the coordinate 0,0 using the *Left* and *Top* fields of the *Image* tab. Then set Frame 3 to 61,37; Frame 4 to 140,86; Frame 5 to 212,120; and Frame 6 to 280,129. The result is a fully optimized animation.

We hope that the techniques we've outlined here will liven up your Web site with eye-catching animations, created the easy way using GIF files. **PC**

William Robert Stanek is a frequent contributor to PC Magazine and the author of Microsoft Windows NT 4.0 Administrator's Pocket Consultant and Learn the Internet in a Weekend. He can be contacted at writing@tvpres.com.



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USER TO USER

Revive the Recycle Bin

When I delete a file in Windows, it doesn't go to the Recycle Bin. It just gets deleted. How can I fix this problem?

Frank Hussey
Peyton, Colorado

PC Somehow, your computer was configured to bypass the Recycle Bin, but you can easily restore the setting. Right-click the Recycle Bin icon and choose *Properties* from the pop-up menu. In the resulting dialog (see Figure 1), make sure the *Global* tab is selected. Check the box that says *Use one setting for all drives*, and remove the check next to the box that says *Do not move files to the Recycle Bin*. You'll probably want to put a check in the

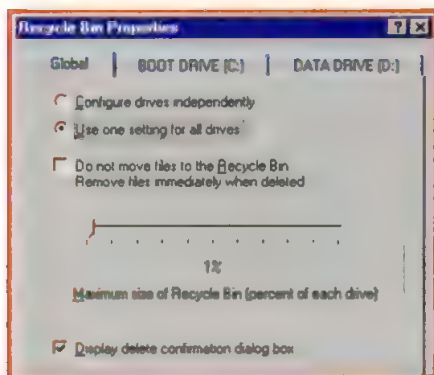


FIGURE 1: You can control how much of each drive is allocated to the Recycle Bin.

box labeled *Display delete confirmation dialog box* as well.

While you have the dialog box open, you may want to adjust the maximum disk space allocated to the Recycle Bin. Each drive has its own Recycle Bin folder, and when the space devoted to recycled files on a given drive exceeds the specified percentage, the oldest files are discarded automatically. For all but the smallest disk partitions, 1 percent of the disk space is probably sufficient.

After making your changes, click *OK*. Now

when you delete a file in Windows Explorer, it will go to the Recycle Bin. If you realize the deletion was a mistake, you can recover the file by opening the Recycle Bin, right-clicking the file, and choosing *Restore* from the pop-up menu.—*Neil J. Rubenking*

Fuzzy Monitor Text

My system has an intermittent problem: I will be reading a page on the Web, and suddenly the words will become fuzzy. Most of the letters on my desktop also turn fuzzy. The only way to clear up the problem is to shut down the computer, wait a few minutes, and then restart; a warm reboot does not help at all. My son thinks it is a software problem, but my husband thinks it is a virus. Do you have any suggestions?

Ressa McCray
via the Internet

PC Your description has two important clues: First, the problem occurs intermittently and apparently without warning. The other factor is that you actually have to turn off the computer and wait a few minutes to clear the problem. Based on this information, the best bet is that both your son and husband are wrong on this one.

If the problem were a software driver conflict, or something similar, a reboot would fix the problem just as well as turning the machine off and letting it sit. The same goes for a virus. The best explanation is that a component on your graphics adapter is failing and has become sensitive to overheating. When it gets too hot, it fails to produce images correctly. When you turn off the system, it cools down enough to function properly again.

To test this theory, try running the computer with the top off so that there is more air flow over the cards. If the problem does not recur, then heat inside the case was probably the cause, and you may want to replace the graphics card.

If running the system with the case open

doesn't prevent the problem, heat could still be the culprit, but there's something else you should check first. If the text gets fuzzy, turn off just the monitor and wait a few minutes before turning it on again. If this clears up the problem, then the trouble is most likely in your monitor, and you should have it repaired or replaced.—*Alfred Poor*

Selective Memory

When I start my computer after it has been turned off for more than a couple of hours, I get a memory test fail message. Usually, after a couple of reboots, the memory test succeeds. Can you tell me what's wrong and how to fix it?

Steve Gale
via the Internet

PC My rule of thumb is that failures that occur when the machine is cold are mechanical, and hot failures are caused by silicon components malfunctioning. In this case, the rule points to a bad memory connection as the problem; as the system heats up and the metal connectors expand, the connection improves sufficiently to let the computer boot.

To fix the problem, try removing all the memory modules. Make certain that the connectors are clean, and remove any dust or debris that may be in the slots. Then reseat the modules firmly; that should clear up the problem.—*Alfred Poor*

Filling in Scanned Forms in Word

Is there any way to use Microsoft Word 97 to fill in a blank form you've scanned and then print it out with both the form and the filled-in blanks?

Nancy Locke
via ZDNet

PC The best way to scan a form and fill in the blanks is with a good forms program, such as Caere's OmniForm. But you can do the job well enough with Microsoft Word. I'll assume you've installed the required graphics filters for Word and that the form is standard letter size, at 8.5 by 11 inches.

Once you've saved the scanned form to disk, open a new blank document in Word. Choose *File | Page Setup*, then *Paper Size*, set the document to the correct orientation—portrait or landscape. Then choose the *Margins* tab, and set all the margins to the minimum size your printer allows.

If you're not sure what the minimum size is, enter a zero for each margin, and choose *OK*. Word will then warn you that one or

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more margins are outside the printable area. Choose *Fix* and Word will enter minimum margins.

Now choose *Insert | Picture | From File* to open the *Insert Picture* dialog box. Select the scanned image, and make sure the *Float over text* box is checked and the *Link to file* box is not. Then choose *Insert*.

At this point you may want to adjust the zoom setting to show the entire page at once. Use either the pull-down *Zoom* menu on the standard Toolbar or choose *View | Zoom* and pick *Whole page*. This is also the point where you should run a quick print test if you have

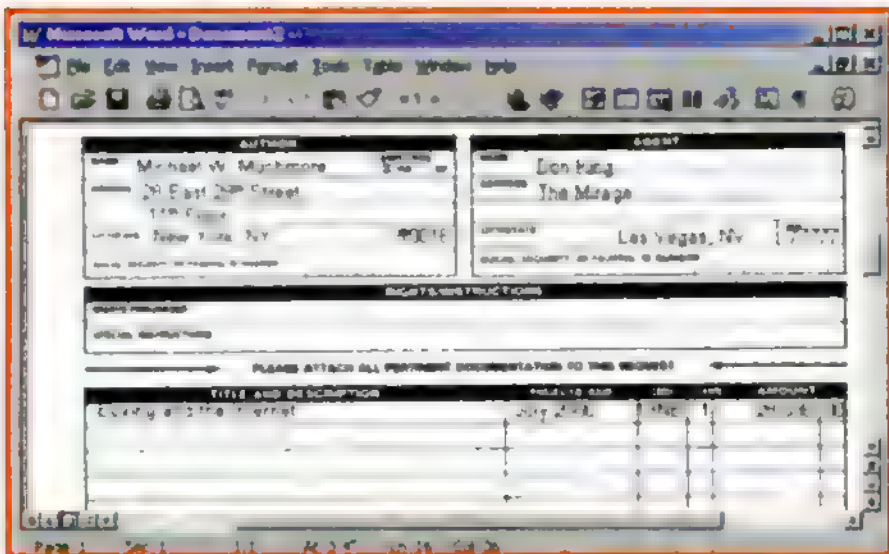


FIGURE 2: You can type over scanned images, but you have to finagle the wrapping settings.

any doubts about the margin settings. Don't worry if Word complains that the margins are outside the printable area. Tell it to continue anyway.

Compare the test printout, the image on-screen, and the original scanned form to see whether the entire form printed out and, if it didn't, whether the problem was in the scan itself or in the margin settings. If the printer cut off any part of the form that shows on-screen, adjust the image size or position.

Now you need to set the image so that you can fill in the form. By default, the wrapping format for an inserted picture is *Top & bottom*, which means you can enter text before or after the image but not on the same line. You need to reset wrapping to *None*. There's a trick to getting the *None* setting to work—at least in the SR-2 upgrade for Word 97, which I used in my tests. If you set the wrapping format to *None* the text will be hidden by the image. If you first set it to *Through*, however, and then reset it to *None* the text will print over the image.

With the form selected, choose *Format | Picture*. Select the *Wrapping* tab, choose *Through*, and then *OK*. Immediately repeat the process, choosing *None* as the *Wrapping* format. Save the file under an appropriate name, like *Blank Form.doc*.

You can now fill in the form by moving to the body text area of the page. To unselect the



form, move the mouse cursor to any place on the page where it changes to its standard shape for selecting text, and click the left mouse button. Switch the zoom setting to a more comfortable size for entering text, and then type as usual.

If you expect to use this form rarely or only once, you can simply type in the text. To adjust

the horizontal position for filling in a blank, use spaces and tabs. To adjust the vertical position, end each line with Enter to insert a carriage return, and choose *Format | Paragraph*, then *Indents and Spacing*, and set the *Spacing Before* to define how far down to start the next line. If you expect to reuse the form very often, you'll probably want to take advantage of Word's form fields to define the positions for the

blanks to fill in. I'll cover that another time, if enough people request it.—M. David Stone

Summing from Separate Worksheets

I need to combine a few worksheets in Excel to determine a total amount paid. Each worksheet has a different filename but the same file extension, .xls, and I want to add up the same range on each worksheet. Does a formula exist for this situation?

Aniel Cruz

New Brunswick, New Jersey

PC The general form for an external reference in Excel is

[Filename.xls]SheetName!CellReference

The workbook name, enclosed in brackets, is followed immediately by the sheet name, which is followed by an exclamation point. At the end comes a cell address, range address, or name.

If there are spaces in any part of [Filename.xls]SheetName, you have to add a single quotation mark before the left bracket and at the end of the sheet name.

You don't have to include the full path of the external workbook, provided the workbook is either open or stored in the current directory. But if the external workbook is

closed, Excel will add the path specification to the reference if you haven't already put it there yourself. And if the workbook is open, Excel will add the path specification as soon as you close it. These details become important if your formula is long. You may be able to reference a set of open workbooks just fine, and then discover when you close the workbooks that Excel, by adding path specifications, has caused the formula to exceed the 1,024-character limit. Your formula will then return a #VALUE! error.

You can use external references in formulas exactly as you would use references to cells on the current worksheet. Thus a formula that adds up the values in A1:A5 of Sheet1 on three worksheets, named Cruz1.xls, Cruz2.xls, and Cruz3.xls, might look like this (if all three files were open):

```
=SUM([CRUZ1.XLS]Sheet1!a1:a5,[CRUZ2.XLS]Sheet1!a1:a5,[CRUZ3.XLS]Sheet1!a1:a5)
```

That is, it would simply supply the three external references, separated by commas, as arguments to the SUM function. When you close the three external worksheets, Excel will add the path specifications and (if necessary) the single quotation marks.

Obviously, the best way to create a formula like this is to point to the external references and let Excel do the typing. You can use the *Window* menu to navigate between worksheets while you're building the formula.

If your formula is long, consider using the *Data* menu's *Consolidate* command instead. The *Data | Consolidate* command is pretty opaque, but if you experiment with it a bit, you can get it to do what you want. In our simple example, the procedure is as follows:

1. Open all three external files (Cruz1, Cruz2, and Cruz3) as well as the worksheet on which you want the files consolidated.
2. Choose *Consolidate* from the *Data* menu.
3. Click in the *Reference* edit box, then use the *Window* menu to display the first external file. Select the cells to be consolidated and click the *Add* button.
4. Repeat step 3 for the other two external files.
5. Clear all three check boxes at the bottom of the dialog box and click *OK*.

The advantage to using *Consolidate* is that you don't have a humongous formula cluttering up your worksheet. The disadvantage is that you don't have a formula at all—hence you have to repeat the consolidation if your external files change. Fortunately, the *Consolidate* command remembers the external ranges you used before, so repeating a consol-

idation is as simple as reopening the dialog box and clicking *OK*.—Craig Stinson

Get Access to Retain Leading Zeros

How can I retain a zero in a number in my database when it's the first digit in that number? When I move the number to a new field, the leading zero always disappears.

William Kantor
Mahomet, Illinois

PC A number of readers have asked this question. Usually the problem results from setting up a field as a Numeric type when it really should be Text. But if you have a field that must stay typed as Numeric, you can use the Format property or the Format function to force the appearance of leading zeros.

Database management systems such as Microsoft Access default to certain standard conventions for displaying data. For numeric fields, they remove leading zeros and right-align data. For Text fields, the conventions are different: information is left-aligned and leading zeros are not removed. Furthermore, numeric fields are stored as numbers, with no leading zeros. Text, on the other hand, is stored as entered. So which type should you choose?

The general rule is this: You should choose a numeric data type only for fields that you are going to use in calculations. A product price is a good example, as it will be used in invoice calculations where quantity multiplied by price will equal a line item total.

An example of a field that should not be stored as Numeric is an account number. An account number will never be used in a calculation, so you're better off storing it as a text field of a set length. That way you never have to be concerned with leading zeros being stripped. Other examples of fields that usually have numeric content but should nevertheless be stored as Text are Zip codes and telephone numbers.

So if you have a field that shouldn't be Numeric, change the data type of the field to Text. To restore the missing leading zeros for values already in the database, you can use an update query. For example, the following update query ensures that all account numbers are five digits long with leading zeros:

```
UPDATE Tbl SET Acctno = Format(
Acctno,"00000");
```

To create the query, select the *Queries* tab in the *Database* window and choose *New*. When the *New Query* dialog appears, select



Design View and choose *OK*. Then when the *Show Table* dialog appears, select your table, choose *Add*, and then choose *Close*. Next select the *Query* menu and choose *Update* query. Enter the following in the query design grid:

```
Field: Acctno
Table: Tbl
Update To: Format(Acctno,"00000")
```

Now select the *Query* menu and choose *Run*. That's it! The field has been updated.

We mentioned that the Format property and Format function can be used to add leading zeros to a numeric field that must remain a Numeric type. The Update query shown above demonstrates the Format function's use. The zeros in the quotes are digit placeholders. Each one tells Access what to do if there is a digit in that particular position. The 0 means display a digit if there is one, otherwise display a zero. For more information on the Format function, see *User-defined Formats* in Access Help.

You could also change the field's Format property. For example, a format of 00000 would always display the number with leading zeros up to five digits (right-aligned however, because the type is still numeric). Once this is set, any new forms or reports you create will inherit the Format property. You will have to change old forms and reports manually.

To change a Field's Format property, open the table in Design mode, select the field, select the *General* tab on the bottom under *Field Properties*, and then change the Format property. When you're finished be sure to issue the *File | Save* command.—Sal Ricciardi

Maintain Order in the Start Menu

Are you tired of having to reorganize the shortcuts on your Start Menu and its submenus con-

stantly so that they appear in alphabetical order? If so, you'll be happy to know you can force Windows to sort these menus automatically every time you turn on your computer.

First, create a setup information file with the following information:

```
[Version]
Signature="$chicago$"

[DefaultInstall]
DelReg=DelRegKey

[DelRegKey]
hkcu,"Software\Microsoft\Windows\
CurrentVersion\Explorer\MenuOrder"
```

Name the file *Sortmenu.inf* and save it in the *Inf* folder (usually *C:\Windows\Inf*). Create a *Registration Entries* file with the text shown in Figure 1. If your *Windows* folder is different, you'll need to adjust the text to reflect this difference. Name the file *Sortmenu.reg*. Finally, double-click the *REG* file to merge its data into the Registry. From now on, every time you start Windows, the Registry key that stores information on the order of your Start Menu shortcuts will be deleted. This deletion forces Windows to sort the Start Menu alphabetically. And there's a bonus: When you open Internet Explorer, you'll find that the Favorites menu is alphabetized as well.

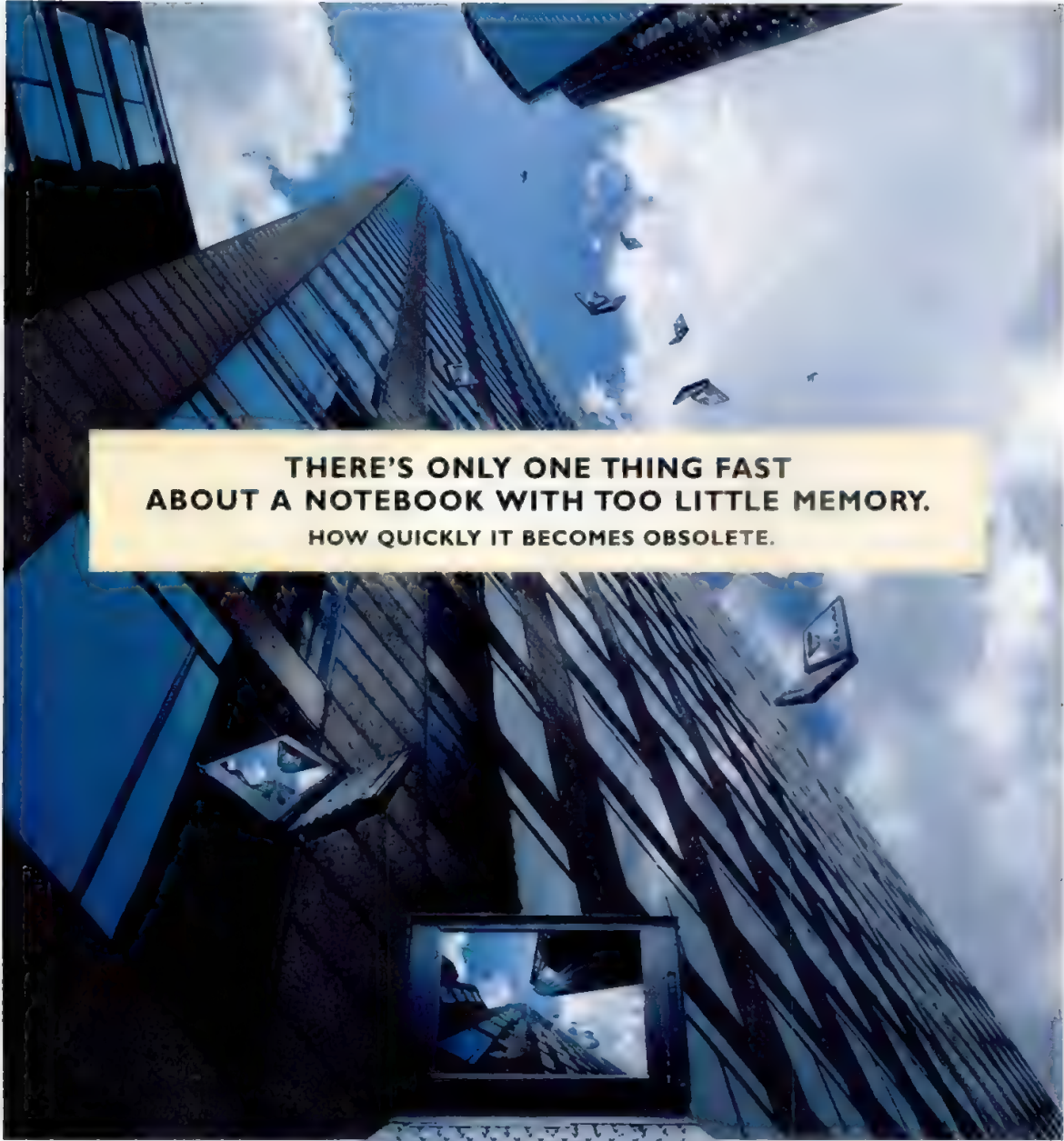
Robert Perry
Starkville, Mississippi

PC If this tip makes no sense to you, that's probably because you haven't installed the Windows Desktop Update. The WDU is part of Windows 98 and is optionally installed along with Internet Explorer 4.0. Without the WDU, Windows always keeps the Programs menu (and its submenus) in alphabetical order. The WDU gives you the ability to reorder menu items by dragging them—at the expense of automatic alphabetization. As long as menu order data is found in the Registry, Windows won't alphabetize the Programs menu.

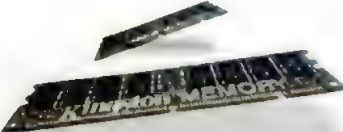
The REG file shown in Figure 1 consists of just three lines, but one of them is too long to display on a single line. When you create this file, make sure you end up with only three

```
REGEDIT4
[HKKEY_LOCAL_MACHINE\Software\Microsoft\Windows\CurrentVersion\RunServices]
"SortMenu"="C:\\WINDOWS\\rundll.exe setupx.dll,InstallHinfSection
DefaultInstall 132 C:\\WINDOWS\\INF\\SORTMENU.INF"
```

TIP This REG file automates the launching of *Sortmenu.inf* so that it occurs every time you start Windows.



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lines. The first line is `REGEDIT4`, the second line is enclosed in square brackets `[ ]`, and the third line begins `"SortMenu="`. Many tips sent to this column involve the use of REG files to add or change information in the Registry. But REG files can only add data to the Registry or change existing data—they can't delete any. For that, you need an INF file, as this tip illustrates.

For another approach to zapping the Start menu back into order, try the *PC Magazine* utility MenuZap, found at www.pcmag.com/utilities. MenuZap restores order when you command it to do so, rather than every time Windows starts. The utility also has the ability to undo the most recent zap.
—Neil J. Rubenking

Spring Cleaning for Outlook Express

My Outlook Express mailbox grows and grows: many folders, many megabytes. I already moved the interesting content to files on my hard disk. Is it safe to delete folders that exist only as MBX files?

Hubert Schonberg
Tel Aviv, Israel

PC Each Outlook Express message folder is stored on-disk as a pair of files with extensions `.mbx` and `.idx`. The MBX file holds the message's contents, and the IDX file is the folder's index. Another file named `Folders.nch` appears to define the relationship between folder names in Outlook Express and the corresponding filenames on your hard disk. The *only* correct way to delete a message folder is from within Express. Right-click the folder, choose *Delete*, and confirm that you want to proceed.

Deleting message folders should not be your primary technique for keeping the program's mailbox files from taking over your disk. You need to review your stored messages from time to time and delete those you no longer need. When you're cleaning your mailbox, you may want to know just how big a message is. Choose *Columns...* from the *View* menu and move *Size* into the list of displayed columns (note that each folder has its own column settings). Click the *Size* heading

to sort messages by size, and consider whether you need to keep the largest ones. You can also click the *Received* heading and decide whether your oldest message are worth keeping.

You should also set Outlook Express to discard deleted items upon exit. Choose *Options* from the *Tools* menu, click the *General* tab, and check the box labeled *Empty messages from the 'Deleted Items' folder on exit*. With the *Options* dialog still open, click the *Send* tab and note the box labeled *Save copy of sent messages in the Sent Items folder*. When this box is checked, the program saves a copy of every message you send. Having copies of sent messages can be very handy at times, but you should make a special point of cleaning out this folder frequently.

Besides clearing out unwanted messages, you must *compact* your folders to recover the space that was occupied by deleted messages. Every week or so, choose *Folder | Compact All Folders* from the *File* menu. If you haven't done this before, you may be amazed at the amount of space it frees. An Outlook Express mailbox has the potential to grow boundlessly, but with a little attention, you can keep it under control.

—Neil J. Rubenking **PC**



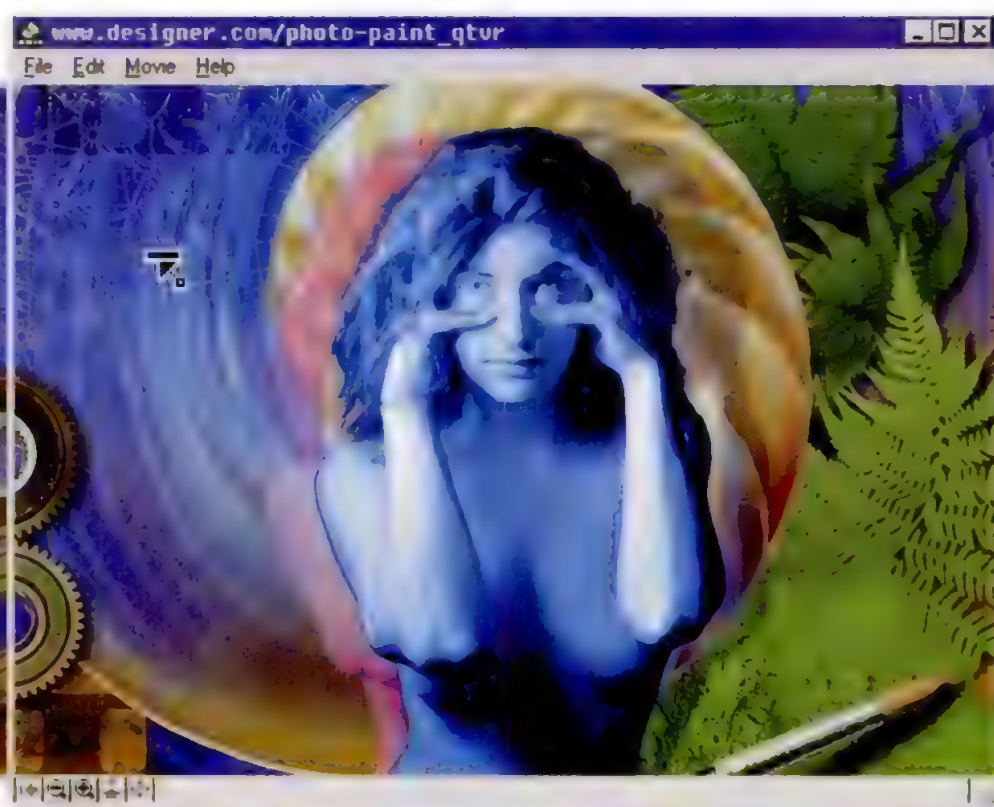
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UTILITIES

Manage Your Passwords

You probably use passwords to log on to your network at the office, to unlock protected files, and to access e-mail, protected Web sites, and other Internet resources. In today's world, you can easily have a dozen passwords or more, and remembering them all can be a challenge. You can use the simple-minded approach of using the same password for everything, but that compromises your security.

This issue's utility, **PasswordPrompter**, is a special-purpose database that provides encrypted storage for all your passwords. The **Password** field is displayed as asterisks, but you can copy and paste its contents directly into a password-entry field. A **Hint** field lets you

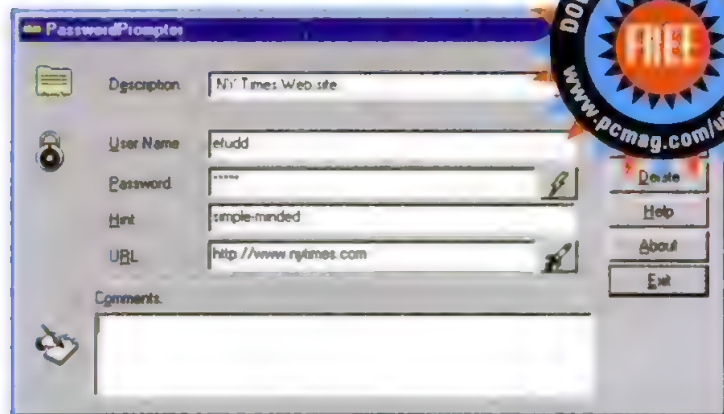
enter a phrase to remind you of passwords you need to enter manually. PasswordPrompter also offers a password-generation feature, which creates hard-to-guess passwords that meet specified criteria.

PasswordPrompter runs under Windows 95, Windows 98, and Windows NT 4. An article about how to use PasswordPrompter and how it was written is available on our Web site at www.pcmag.com/utilities. A link to download the utility and its source code can also be found there.

Steven E. Sipe, the author of PasswordPrompter, is a developer based in Wilmington, North Carolina. Sheryl Canter is the editor of the Utilities column and a contributing editor of PC Magazine.

PASSWORDPROMPTER'S MAIN WINDOW is a data-entry form that contains the fields Description, User Name, Password, Hint, URL, and Comments. Click the New button to clear the form in preparation for entering a new record, and click Save to store new or changed records. The Description field combo box contains the list of stored password records.

The password is displayed in the form as asterisks but can be copied and pasted directly to a password entry box. You can specify a filename in the url field by starting the string with file://. This lets you use PasswordPrompter to launch password-protected ZIP files or other files encrypted with password protection. Click the button next to the URL to launch it



COMPUTER-GENERATED PASSWORDS are much harder to guess than passwords that you choose. PasswordPrompter generates passwords that meet the criteria for a particular Web site or application. You can specify the password length, whether to use uppercase or lowercase, and the types of characters (letters, numbers, and symbols) to be used in the first position and in subsequent positions.

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INTERNET BUILDER

Bitmaps and Vectors: Web Graphics Evolve

By William Robert Stanek

Internet speed—the term reflects the furious rate of Web development. But graphics, so crucial to the Web's growth, haven't kept pace with other technologies. GIFs are great for the grunt work—simple images, buttons, and the like—but they're limited to 256 colors. JPEGs handle the fancy stuff—digitized images, of high resolution and high color—but lose image quality when compressed too much. Other solutions such as ShockWave or Flash can dazzle but require plug-ins that users may not have.

Happily, new solutions are emerging. Recently, the Portable Network Graphics (PNG) format has come of age, offering alpha channels for variable transparency, two-dimensional interlacing for advanced progressive display, and gamma correction for independent brightness controls. And the next trend in Web graphics—using vectors instead of bitmaps—promises all that plus scalability and smaller sizes. We'll take a look at traditional technologies and then explore the evolving world of graphics standards on the Web.

THE OLD STANDBYS

CompuServe's Graphics Interchange Format (GIF) is the most widely supported and used image format in the world. Two versions of the format are used on the Web: GIF87a and GIF89a. GIF87a, the original specification, has been available since 1987. Its major features are lossless compression and support for interlacing (separating the lines of pixels in an image into groups that display in stages.) GIF89a is an extension that adds animation and transparency. Versions of Netscape Navigator since 2.0 and of Microsoft Internet Explorer since 3.0 support both GIF formats.

GIF is a bitmapped image format with indexed color. Bitmapping is the process of storing color values for the bits that make up an image's pixels. GIF images use RGB (red, green, blue) color values to determine the color of a pixel, such as 255, 255, 255 for white or 0, 0, 0 for black. These color values are stored in a palette and are represented by a

single value that is an index to the color palette. By storing indexes rather than the actual RGB values in a color palette, and by using a compression routine, GIF can achieve a compression ratio of about 4:1, meaning the compressed images are about one-fourth their original size. Smaller images require less disk space to store, use less network band-

width, and download more quickly.

GIF's major drawback is that a single image can contain only 256 colors. Though restricting, many images use only a few colors, especially the buttons, bullets, and navigational tools that accent Web pages.

JPEG is a standard for still image compression developed by the Joint Photographic Experts Group. It was designed for storage and transmission of photograph-quality images. Like GIF, JPEG is a bitmapped image format

where pixel values are stored in image files. Unlike GIF, JPEG doesn't use indexed color, and it doesn't support transparency, interlacing, or animation.

JPEG supports true 24-bit color, which means each pixel displayed on the screen has 24 bits of information associated with it. As there are 480,000 pixels on an 800-by-600 screen, you can imagine how quickly true-color images can eat up hard disk space. Fortunately, JPEG supports powerful compression algorithms that reduce disk space requirements dramatically. Some images can be reduced to 1/20 their original size.

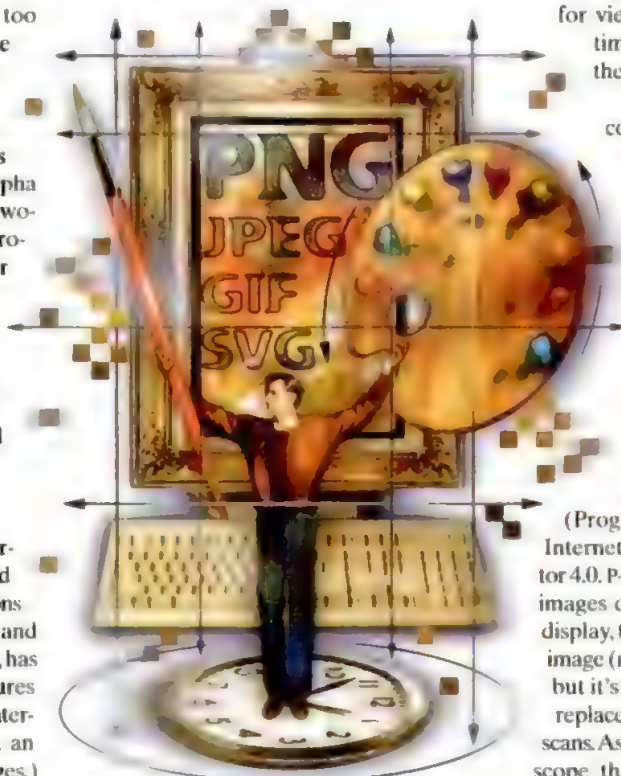
Compressing an image to that extent does have drawbacks, however. First, JPEG compression is *lossy*, meaning that some information is lost in the compression process. Depending on how the image is compressed, this loss may or may not be perceivable. Moreover, such images generally take longer to decode for viewing, though the actual decoding time depends on the user's system and the amount of compression.

JPEG enables you to use brilliant colors and provides support for complex images and digitized photographs, but it's not designed for use with simple images. JPEG compression may distort such images, especially if they have few colors or large areas of the same color. Also, JPEG compression is not as effective as GIF compression in reducing simple images' sizes. JPEG compression is designed for complex, high-resolution images and is inefficient with basic, low-resolution ones.

An extension of JPEG, called P-JPEG (Progressive JPEG), is implemented in Internet Explorer 4.0 and Netscape Navigator 4.0. P-JPEG supports progressive display of images during download. With progressive display, the first image you see is a complete image (not just a subset of the lines of pixels), but it's very low quality. Successive phases replace this image with progressively better scans. As if you were gradually focusing a telescope, the image gets more detailed during each stage until it finishes loading.

PNG: THE NEXT EVOLUTION

In 1995, a controversy erupted over the use of GIFs when Unisys Corp., which owns the LZW compression the format used, and CompuServe, which licensed it, decided programs implementing GIF would have to pay royalties. That controversy sparked the development of a new, improved format: PNG (Portable Network Graphics). Created by an informal Internet working group and adopted by the W3C in



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1996, PNG was designed to meet or exceed GIF's capabilities, to be easy to implement, and to be completely portable. It is royalty-free with full source code publicly available. The specification was updated to Version 1.1 in December 1998, bringing improvements for gamma and color correction as well as clarification of key features.

PNG supports indexed color, true 48-bit color images, and 16-bit gray-scale images, as well as a fairly advanced two-dimensional interlacing method called Adam7, which displays an image progressively in seven stages and is much more powerful than the four-stage method used with interlaced GIFs. As a result, progressive PNGs appear to display faster and become intelligible sooner than interlaced GIFs.

PNG's advantages go far beyond its support for color and pixel types, though. PNG supports alpha-channel transparency with true color and gray-scale images. The alpha channel lets you set the level of transparency for each pixel in the image, meaning you can create multi-colored images that are partially or fully transparent. With images that use indexed colors, the transparency information can be attached to individual colors in the color palette, so you can get the benefits of an alpha channel without the per-pixel overhead.

For accurately displaying colors, PNG supports gamma correction and chromaticity. With gamma values, browsers can display images using the colors and lighting effects that the original author intended. *Chroma* represents the strength of the RGB colors in the image's pixels, and when combined with gamma correction, chroma values allow for more accurate color matching.

Additionally, PNG supports lossless compression using filters and a strong compression algorithm. Essentially, the mechanism works like this: Before an image is compressed, filters are applied to optimize image data. Because these filters are applied on a line-by-line basis, each line of the image can be optimized independently. Afterward, the image is compressed using a derivative of the LZ77 method used in Zip, Gzip, and other popular compression programs. The result is a high compression ratio without loss of data.

Despite PNG's many attractive features, it has yet to displace GIF or JPEG. Lack of sup-

port by mainstream browsers and the absence of alternate image types for noncompliant browsers were key factors hindering the format's widespread adoption. Fortunately, these factors should soon be irrelevant. PNG received the official stamp of approval by Microsoft in Internet Explorer 4.0 and by Netscape in Navigator 4.04. (Before this, PNG support was available only through plug-ins.) Though support in these browsers is limited primarily to standard features and progressive displays, IE 5.0 and Navigator 5.0 should fully support all of PNG's features. Part of this support is the ability to use the HTML 4.0 object

large and may take a lot of time to download.

Enter vector graphics, a solution to the Web's reliance on bitmapped images. Rather than tracking and storing bits, vector graphics use instructions to draw lines and fill shapes. A handful of instructions can often replace a bitmapped image of several kilobytes.

As you probably know, vector graphics aren't new. They are widely used to create diagrams in graphics programs and are also supported by browser plug-ins. But the latest Web-ready vector formats are different.

Most traditional vector graphics rely on proprietary formats and are not standards-based; Web-ready vector formats, on the other hand, are standards-based and come in non-proprietary formats as markup languages. If you're familiar with HTML, you know that markup languages use plain text to define tags and other elements. Text-based markup elimi-

ates many of the disadvantages of bitmaps. The publisher can update markup manually, or the update can occur dynamically when the page is viewed, without the need to re-create images in an editor. This means you can alter fonts, colors, and other image properties wherever and whenever necessary. Vector graphics are also scalable, meaning you can resize them as needed for viewing or printing.

Another major ad-

vantage of vector graphics based on markup languages is that image contents can be selected, indexed, and searched. Text in vector graphics can link to other elements, so if you click on a link you can access new information. Search engines can index the textual contents of vector graphics, making it possible for people to find text within diagrams, flow charts, schematics, and so forth.

Unfortunately, Web-ready vector graphics aren't quite ready for prime time yet, mainly because no single standard existed until recently, and no single format is implemented as a mainstream component in the latest generation of Web browsers, although many standards have been proposed. With any new concept, there's always a flood of innovation, certainly the case with vector graphics for the Web. Many different organizations are vying to have their versions selected as the standard on the Web. Formats suggested include Web Schematics, DrawML, PGML, and VML.

WEB GRAPHICS FORMATS: A COMPARISON					
✓ YES X NO	GIF87a	GIF89a	JPEG	P-JPEG	PNG
Maximum color depth	8-bit	8-bit	24-bit	24-bit	48-bit
Compression type	Lossless	Lossless	Lossy	Lossy	Lossless
Interlacing	✓	✓	X	✓	✓
Animation	X	✓	X	X	X
Transparency	X	✓	X	X	✓
Variable transparency	X	X	X	X	✓
Gamma correction	X	X	X	X	✓
Browsers	Explorer, Navigator	Explorer 3, Navigator 2	Explorer 2, Navigator 2	Explorer 4, Navigator 4	Explorer 4, Navigator 4.04

tag to display PNG images. The object tag presents a viable way to present alternate image types for noncompliant browsers. Look for PNG to take off as the 5.0 browsers hit the streets. To be sure, it'll be interesting to see whether PNG makes any headway before the next trend in Web graphics takes over.

NO MORE BITMAPS

Despite their popularity, bitmaps have many disadvantages. You are tied to the individual bits of data within an image. Once an image is created, it is essentially frozen. If you want to modify text or any other element within an image, you need to recreate it. And you can't easily resize a bitmap; the resulting image is often blurry or may have jagged edges. Printing bitmaps can also present problems. Images that look good on the screen may not look good in print, especially if the sizes are different. Perhaps most important, at least as far as the Web is concerned, bitmapped images tend to be

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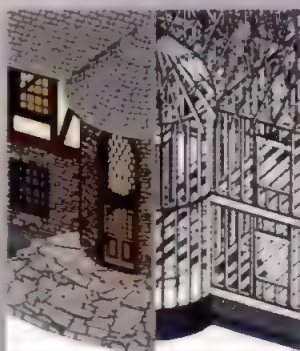


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SOLUTIONS



Web Schematics is a markup language for creating flow charts and other diagram types. At its core, Web Schematics seeks to re-create the schematic drawing capabilities of the basic drawing tools built into document production systems such as Adobe FrameMaker and Microsoft Word, using the rendering and presentation models inherent in HTML and CSS1. This means you should be able to draw lines, rectangles, polygons, arcs, and other shapes and to apply fill patterns, pen patterns, and line widths.

Like Web Schematics, DrawML is a markup language for creating flowcharts and diagrams. But while Web Schematics relies on HTML and CSS, DrawML is an application of XML (Extensible Markup Language) that makes extensive use of Java to define the shapes that are drawn on the screen. Using Java, DrawML can create complex diagrams with relatively few markup instructions. A key ingredient for ease of use is the fact that all DrawML shapes have hook positions used as connection points. To connect objects together, you have only to tell the renderer which object to attach to and which hook position on the object to use.

PGML (Precision Graphics Markup Language), proposed by Adobe Systems, lets Web developers leave behind the world of basic diagrams—if they want to—because the language is designed to produce very precisely rendered graphics as well as diagrams and charts. PGML's power comes from the imaging models it borrows from: Adobe's PostScript and PDF (Portable Document Format). PGML is an application of XML, but its imaging model is an instance of the Resource Description Framework (PDF) data model. In adapting this model, Adobe proposed many enhancements, including support for transparency, progressive display, and anti-aliasing, as well as hooks for scripting animation and dynamic behavior.

The vector graphics format proposed by Microsoft is called VML (Vector Markup Language). VML is an application of XML that uses CSS2 (Cascading Style Sheets, Level 2) to lay out graphics within a document. Microsoft designed VML to be easily hand-edited. Most markup tags and attributes have short, descriptive keywords, and more important, these keywords make sense. VML can make use of standard imaging techniques such as transparency, gamma correction, and chromaticity. VML also supports animation, scripting, and the rendering of complex images using mathematical equations. At times, VML goes back

to familiar roots to get these core features. For example, though VML supports hyperlinks, it doesn't define user interface behavior. Instead, VML relies on standard HTML mechanisms to control viewer behavior.

SCALABLE VECTOR GRAPHICS

Each of these competing formats have their strong points. Nevertheless, the W3C decided to create its own format for vector graphics: Scalable Vector Graphics (SVG). SVG is an application of XML that supports CSS2 and other key technologies. SVG developers understood that the range of printable colors and the range of colors visible on the screen may be different. Because of this, they based SVG's color-matching capabilities on the concept of *gamut*, which is the range of colors an output device supports. SVG also supports gamma correction and chromaticity through the use of gamma values and color profiles.

Because SVG is usable as an XML namespace, SVG graphics can be defined in documents that contain other XML tag sets without accidental namespace conflicts. SVG is designed to be used as a standalone document format as well. In this case, the SVG file represents a complete drawing, chart, or diagram and can include links to other works.

SVG has many advanced features such as filters, interactivity, and animation with key innovations for the Web. For example, SVG's filter effects are implemented using an enhanced transformation technique, which is based on how effects are handled in bitmapped graphics. Traditional vector graphics are specified abstractly with markup and rendered through a geometric transformation that takes place in a single phase. SVG adds steps to the transformation process, whereby graphics are rendered onto an intermediate continuous-tone image, which is then rendered through applicable filters to the output device. This multi-phase process can allow for cool effects such as 2-D images with 3-D looks.

A key goal of SVG's creators was to implement a standard that can be used as soon as possible. Instead of waiting a year or more for the format to evolve—as with most specifications—SVG has an expedited timetable. The W3C started work on SVG late in 1998 and issued a list of requirements in November of that year. By February 1999, the W3C had already issued its first working draft with the goal of making SVG a proposed recommendation by July. With any luck, this new standard will soon give Web developers a new tool for building more pleasing sites. **PC**

William Stanek is a frequent contributor to PC Magazine.

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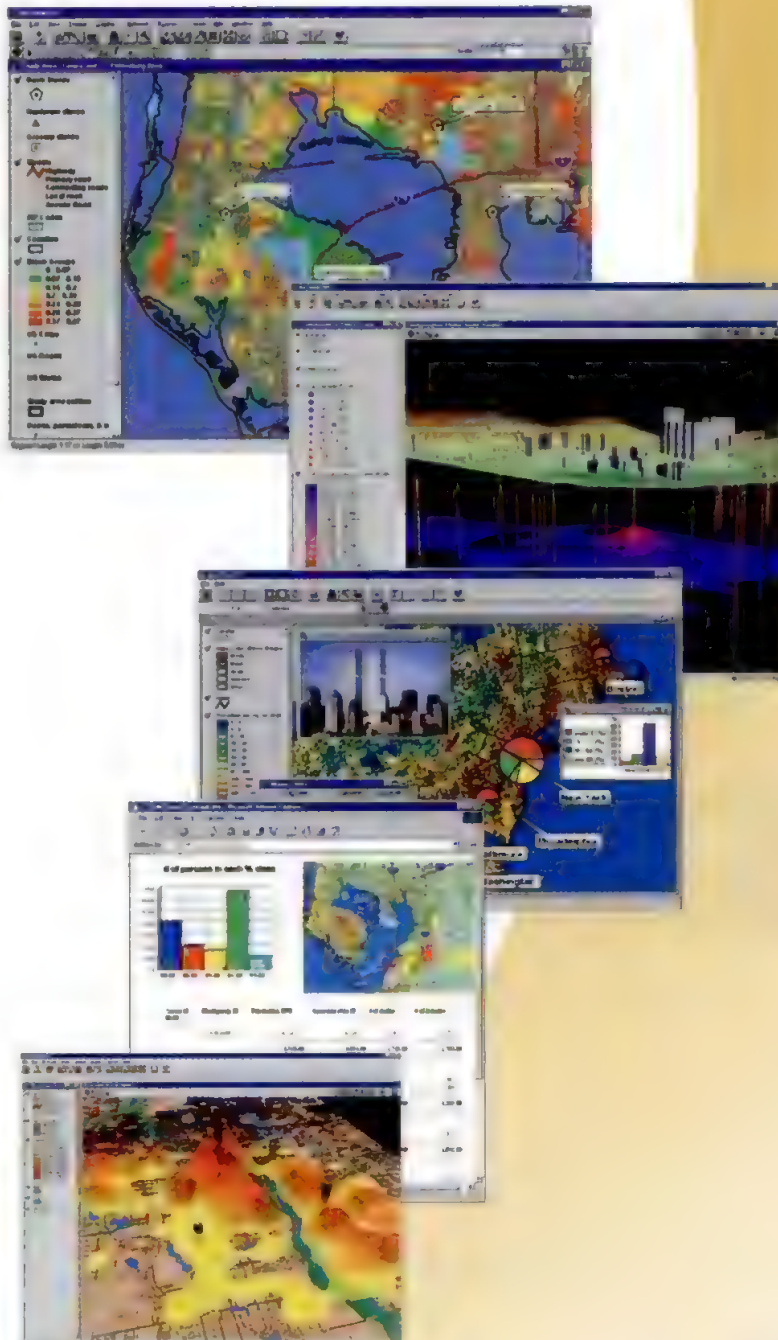
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PC TECH

Linux 2.2 Gives NT a Run for Its Money—for Free

By Neil Randall

Microsoft is worried. The last time the company was in this predicament, Netscape had just started up and Bill Gates suddenly discovered the Internet. But it's one thing to fight off a single company and quite another to stop a worldwide revolution. That revolution is Linux, the POSIX-compliant Unix operating system, now out in Version 2.2—a significant new update.

For the cost of a download, you get a feature-rich version of Unix that runs on platforms ranging from 386s to SPARCstations, gives you superb Internet tools, including the extremely popular Apache Web server, and runs an increasing collection of applications and utilities, many available free from such download sites as Linuxberg (www.linuxberg.net) and Freshmeat (www.freshmeat.net). Several computer makers, including big names Dell and IBM, are even offering desktop systems with Linux preinstalled, either alone or as a dual boot with Windows 98 or NT.

And Linux keeps getting better with each release. With Linux 2.x, not only is this open-source operating system gaining support from third-party developers (including heavies such as Corel and IBM), it also now approaches and in some cases even surpasses Microsoft's high-end OS, Windows NT 4.0, in areas such as scalability and support for 64-bit processing and multiprocessing.

You also need far less hardware to run Linux than Win NT; a good old Pentium/166 is just fine, and you can even press that 386 doorstep into service. Furthermore, Linux is much less likely than Win NT to need rebooting after running for weeks and even months. Windows NT is widely acknowledged as having a more user-friendly interface, but Linux users like the control they have over their OS.

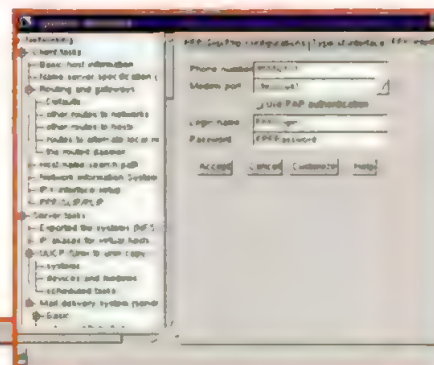
Unix remains the dominant operating system for Internet servers. Linux makes Unix

even more central to the Net, because it runs on PCs and thus could vastly increase Unix's presence. Moreover, Apache—the most widely used Web server software—runs best on Unix. (The latest version of Apache runs on Win32, but not as fast as on Unix.) Combining a Linux-based PC with Apache server software results in a powerful, low-cost Web server, which you'll see used increasingly on both low- and high-traffic sites. (For a PC Magazine Labs-tested comparison of Web server platforms, see the "Serve It" section of this issue's feature "Create a Great Site.") You can expect to see more Linux Web servers and Web clients as well.

So let's dig in. We'll start with a look at the major enhancements to the new kernel (that

stations, Alpha and SPARC systems, and even Amigas and older (68K) Macs. Windows NT, by comparison, runs on 486 or higher systems, Alpha stations, and SGI Virtual Workstations. In the case of Alpha and SPARC, the Linux 2.2 kernel supports 64 bits, so if Intel ever releases the 64-bit Merced, Linux will be ready with a native 64-bit kernel.

It's unlikely that Windows NT will offer 64-bit support until significantly after Merced's introduction. If Intel does a good job selling IT departments on the benefits of 64-bit processing, those departments might well consider 64-bit Linux as a possible enterprise server OS and adopt it before 64-bit Win NT is ready. If that does happen, Win NT will have a hard time displacing these high-powered Linux systems.



An increasing number of GUI-based applications are becoming available for Linux, including linuxconf, a system configuration utility.



Linuxberg.com is a popular place on the Web to turn for Linux software downloads.

is, the core OS components). Then we'll examine the Internet and networking features in 2.2, along with a related discussion of file system changes and additions. A brief comparison with Windows NT runs throughout the sections, to show you how the two systems stack up.

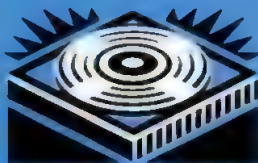
KERNEL ENHANCEMENTS

The 2.2 kernel offers a number of improvements over earlier versions. First and foremost, its cross-platform support is far more extensive. The new kernel will run on x86 machines with 386 or higher processors, the Apple PowerPC line, SGI Virtual Work-

Many of these platforms—Intel (P11 and higher), Alpha, SPARC, and SGI—support multiple CPUs, and 2.2 offers improved support for symmetric multiprocessor architectures. Though the same 16-processor limit supported in the 2.0 kernel still holds, 2.2 enhances the feature dramatically.

The earlier version prevented two or more processors from accessing the kernel's services simultaneously, by locking the kernel as soon as one processor requested a service (*global lock*). By contrast, 2.2 supports multiple locks (they're called *spin locks*), and this feature allows multiprocessor access to the kernel as long as no two CPUs request precisely the same service. The result is a faster multiprocessing system with less idle time, and this speed pays off with, for example, large-scale Web servers handling simultaneous requests from many users. Win NT allows up to 32-way symmetric multiprocessing but works best with a maximum of four processors.

Another benefit for large-scale servers is



PC TECH

the new kernel's improved support for RAID (Redundant Array of Inexpensive Disks), which lets hard disks mirror one another on the fly so that disk failures won't result in the loss of either data or system functionality. (RAID can also be used to store one set of data across several hard disks in one write operation.)

This support isn't perfect, though: Linux 2.2 won't automatically recognize all the disk arrays at boot time (administrators must set them, but this can be scripted), and you can't replace defective drives when the system is running (hot swapping isn't supported). You can, however, expect an upgraded RAID driver in a near-future kernel upgrade to offer these enhancements as well. Version 2.2's RAID support brings Linux closer to

and-play support remains limited to parallel ports (although you can find some PnP drivers on the Net at such download sites as www.linuxberg.com), but Linux now supports a wide range of IDE devices beyond hard disks. Ultra-DMA data transfers are also built in, along with bus-master DMA.

Linux 2.2 also helps solve one of Linux's most frustrating installation problems—an unrecognized video card—by introducing direct graphics support. Here, a frame-buffer console driver lets your system's X Window

still not point-and-click, but 2.2 includes full documentation for kernel configuration, and as this feature gains popularity, you can expect the interface to get friendlier.

A BETTER INTERNET OS

The whole point of Unix has always been networking, including the incorporation of non-Unix systems into Unix-based networks. Linux is no different from other Unix platforms in this respect, and in fact, it was never really designed as a standalone workstation OS, as was DOS or early Windows. These networking capabilities are essential to establishing Internet servers. Linux has long been recognized for its ability to let you establish inexpensive servers, and the 2.2 kernel will only increase that recognition.

Network operating systems often have to contend with multiple file systems, and Linux has been as good or better than any in file system compatibility. For example, Windows NT can read and write only FAT, FAT32 (Windows 2000 only), SMB, and Win NT's native NTFS (which will change in Win 2000). Linux supports far more. In addition to its two native file systems, EXT and EXT2, and its virtual PROC file system, Linux shares Windows NT's ability to read and write FAT and FAT32, though it can only read from (not write to) NTFS.

Beyond Win NT's file systems, Linux supports UMSDOS, which lets Linux run from a DOS partition instead of a Linux native partition; SMB, for Windows for Workgroups and LAN Manager compatibility; and NCPFS, for compatibility with NetWare clients and servers. Furthermore, Linux is compatible with Unix's NFS, UFS (BSD and Solaris), SYSV (Xenix and SCO), and the Amiga Fast File System (AFFS), along with Carnegie Mellon's advanced distributed file system, CODA. Such wide file system support, combined with Linux's platform support, allows it to be installed and used on a wide variety of systems. Windows NT, by comparison, can be installed as a dual boot on fewer systems and with much less file access.

IP SUPPORT

Important for intranets, Linux now supports IP tunneling, which lets you configure a machine to belong to a network different from the one to which it is physically attached. Tunneling uses the Internet Protocol (IP) to transport data that's encapsulated according to the needs of other network protocols. Windows NT's tunneling comes in the form of Virtual Private Networking (VPN), which lets you use an IP connection to transport network data from non-IP network protocols such as IPX

LINUX 2.x VS. MICROSOFT WINDOWS NT 4

YES ☒ NO ☒	Linux 2.x	Windows NT 4
Open source code	☒	☒
Platforms supported	x86 (386 and up), Alpha, Apple 68K, Apple PowerPC, SGI Virtual Workstation, SPARC, portable to other Unix	x86 (486 and up), Alpha, SGI Virtual Workstation
Support for 64-bit processing	☒	☒
File systems supported	AFFS, CODA, ext, ext2, FAT, FAT32, FFS, HFS, HPFS (read-only, OS/2), NCPFS, NFS, NTFS (read-only), PROC, SMB, SYSV, UFS, UMSDOS	FAT, FAT32, NTFS, SMB
Support for IP tunneling	☒ (only within IP)	☒ (as VPN with non-IP protocols)
Built-in support for TCP/IP Version 6	☒	☒
IP multicast routing	☒	☒
IP masquerading	☒	☒
Serial line load balancing	☒	☒
Symmetric multiprocessor support	☒	☒
Support for RAID	☒	☒
Including hot swapping	☒	☒
Including boot-time disk recognition	☒	☒
USB support	☒	☒
Plug-and-play support	Poor	Fair
PCMCIA support	Poor	Good
Length of time between necessary reboots	Excellent	Good

parity with Win NT 4.0, which already offers a rich RAID environment, including support for the boot-time and hot-swapping features that Linux lacks.

Kernel 2.2 has good news for all Linux users, not just network administrators, in its support for additional hardware. The kernel now supports infrared (IrDA) ports, ISDN modems, and more SCSI controllers than it did previously. TV tuner cards and video capture cards are enhanced through a new driver (BTTV), which, among other things, lets the card write directly to memory, bypassing the CPU, to produce a higher-quality image.

Sound cards are also more widely supported, as are more of those essential business tools, joysticks and game controllers. Plug-

server treat the video buffer as a separate device and remain independent of the card.

RECOMPILE NO MORE

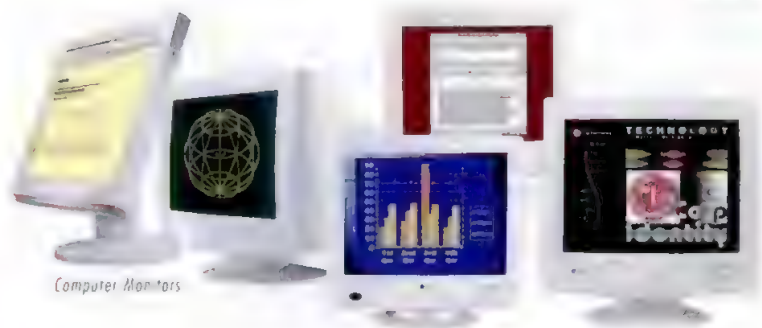
The 2.2 kernel also helps reduce the need to perform a task that frightened many users trying to switch from Windows or Mac machines to Linux: recompiling the kernel. Until Version 2.2, configuring the kernel meant that you had to rebuild and recompile the existing one.

Linux 2.2 still lets you rebuild and recompile the kernel to your heart's content (otherwise Linux devotees would launch a global revolution), but you can now change the kernel's configuration through Linux's virtual file system instead of rebuilding and recompiling. It's



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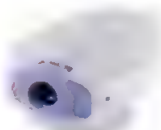
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and NetBEUI. Linux's new IP Tunneling feature handles only IP within IP, and is therefore less flexible than Win NT's, but the important point is that the feature exists at all. The Linux community will no doubt add other tunneling drivers to let IP transport data from other protocols, such as the ones Linux already supports (IPX, AppleTalk, SMB, and LLC).

The Linux 2.2 kernel supports TCP/IP Version 6 (IPv6), the forthcoming upgrade to existing IPv4. IPv6 expands IPv4 by supporting such features as expanded addressing, new and future authentication and privacy implementations, simplified header formats, increased support for mobile users, and ease of configuration (see www.ipv6.org for more details). Neither Win NT 4 nor Win 2000 offers built-in IPv6 support, although Microsoft provides information about its upcoming IPv6 implementation for both systems on the Web (www.research.microsoft.com/msripv6). That Linux's support is in place lets developers start implementing IPv6 versions of their products and programs for Linux early, which will be a draw for administrators of advanced networks.

Support for two other IP protocols has also been added to the 2.x kernel. First, IP multicast routing is now included with the kernel. This feature enables a system to send the same packets at the same time to more than one computer on the network—the standard Internet way is to send copies to every addressee—and thus to engage in Mbone videoconferencing and other live over-the-Net events, not just as a client but as a server as well. Neither Win NT 4 nor Win 2000 supports IP multicast routing; thus they can't act as servers, although they do let programs such as Microsoft NetMeeting act as multicast clients. Since IPv6 actually enhances Mbone capabilities, Linux's support gives it another potential advantage.

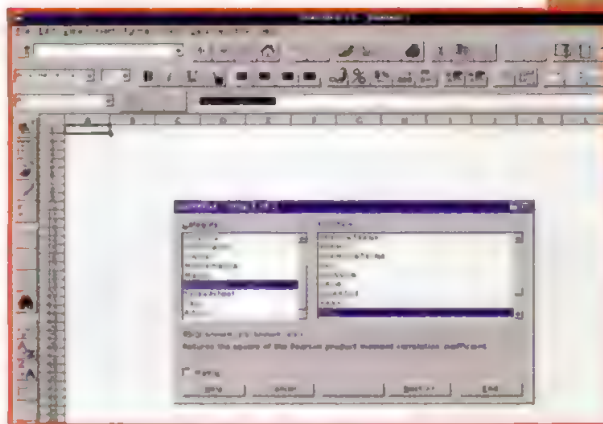
Another feature, IP Masquerading, lets your entire network appear to the Internet as a single IP address, as though the network were operating through a firewall; Win 2000's Network Address Translator performs a similar function. For dial-in connections, 2.2 offers serial-line load balancing, letting you connect to an ISP through two phone lines and two modems to double the connection speed. As with Windows' multilink feature, the ISP must be set up to allow such connections.

Configuring the network interface in Linux 2.2 now automatically establishes routes for existing local networks: You no longer need to add them manually. In fact, the 2.2 kernel offers far greater flexibility for customizing routing decisions, letting administrators, for

example, schedule packets for specific behaviors according to specific traffic-congestion problems. And data can be routed according to a range of criteria, such as the originating IP address. These capabilities, along with a new rules-configuration manager for firewalls, enhance both the power and the ease of implementing networks in Linux.

SO IT'S PERFECT, THEN?

No, Linux is not perfect. With the 2.x series of kernels, Linux continues to evolve, and because of the specific features in its evolution,



The Linux application suite Star Office has great compatibility with Office 97. Versions are also available for Windows and OS/2.

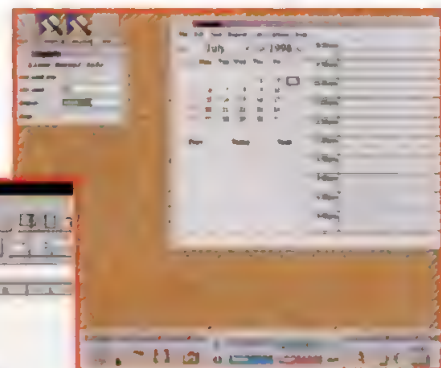
combined with the installation enhancements offered by the major distributors of the OS, it will continue to cut into Microsoft's still vastly superior share of desktop and (especially) server installations. But apart from the fact that organizations and individual users alike still feel nervous about working with an operating system that comes from—and is supported by—no central source, the fact remains that Linux 2.2 still lacks features that have become crucial to many users. Crucial, at least, if massive adoption of the OS is the goal.

First, support for plug-and-play is still poor. Of course, you could say the same about Microsoft's PnP, but try installing even a commercial distribution of Linux (from Caldera or Red Hat, for instance) and Windows 98 on the same machine and Win 98 will automatically detect and configure far more devices. If you're coming to Linux from the Mac, which has always had superb plug-and-play support (so good, in fact, it didn't even have to be called PnP), you'll find this even more frustrating. Getting the video system to work with X Window is better

than before but still too difficult for many—indeed possibly most users—as are the disk-partitioning requirements at installation.

Another problem that remains in the new kernel is the dearth of drivers for PCMCIA cards. If you're connecting your notebook to your LAN via a PCMCIA network card, and to the Internet from the LAN, you'll have to find drivers from your manufacturer (not all offer Linux drivers) and install and configure them yourself.

In addition, kernel 2.2 doesn't support the Universal Serial Bus, although experimental



XFCE (www.xfce.org) is an X Window add-on that offers a customizable toolbar along with a window manager and other utilities.

versions are available. This isn't a huge problem yet, but as more USB peripherals appear, the lack of support could render some systems unusable. This is obvious with such fundamental USB devices as keyboards and mice, but it will also be true as USB modems make their appearance, and that will affect Internet functionality. So will the slow arrival of support for cable modems and DSL modems, but that's also the case with cable and DSL services themselves. Still, as such services become widely available, Linux users will want immediate support; Linux seems made, in fact, precisely for such high-speed connectivity.

There's no doubt, however, that Linux will continue to grow as an Internet server platform, and—to a lesser degree—as an Internet client. The 2.x family of kernels ensures an increased acceptance. All of this means, of course, that the Linux/Win NT debate will continue to thrive, especially given the fact that new Linux kernel versions will continue to appear, with a growing number of features and compatibilities, as network administrators await the long-delayed Windows 2000. No wonder Microsoft is nervous. **PC**

Neil Randall is a contributing editor of PC Magazine.

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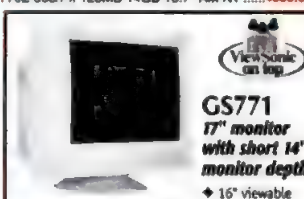
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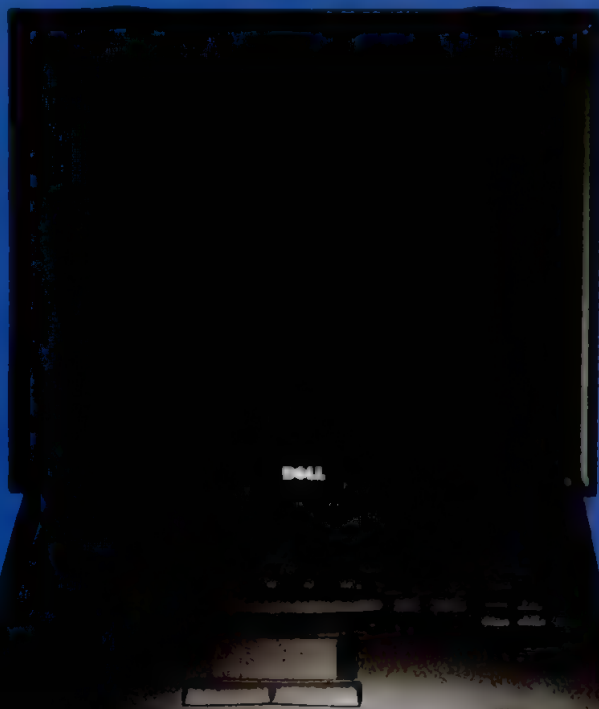
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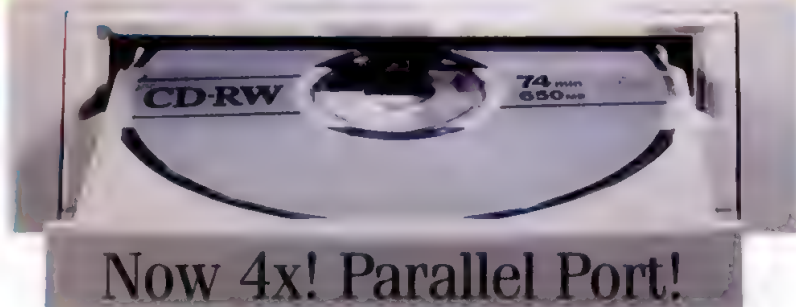
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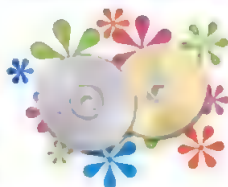


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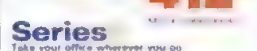
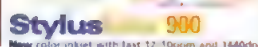
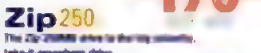
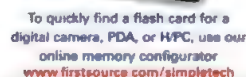
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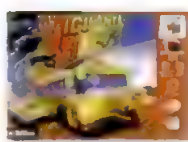
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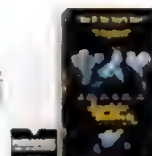
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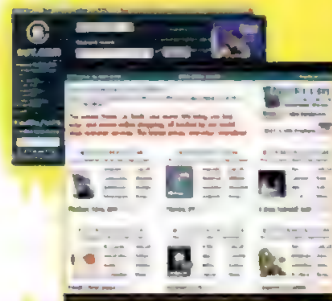


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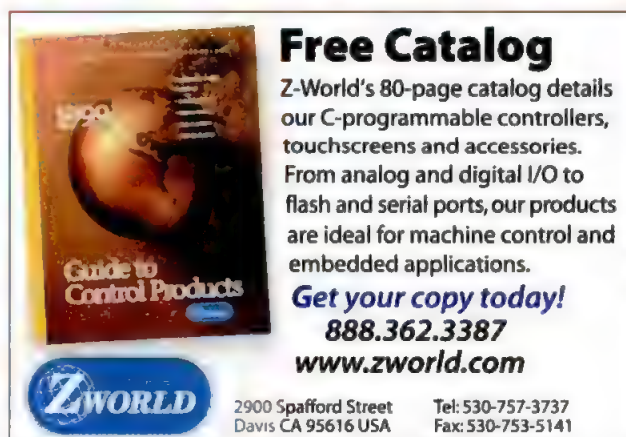
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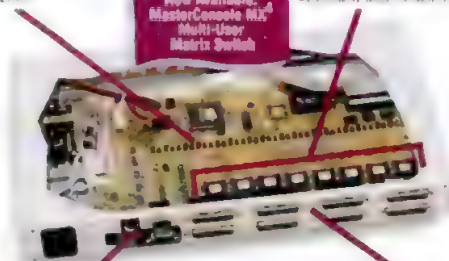
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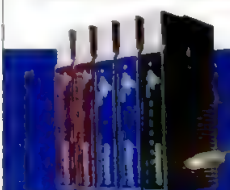
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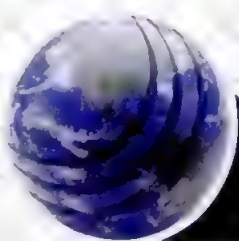
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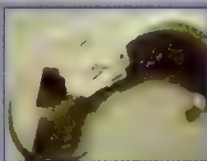
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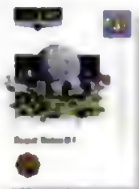


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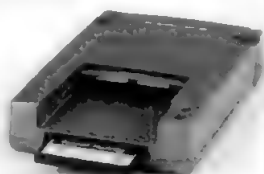
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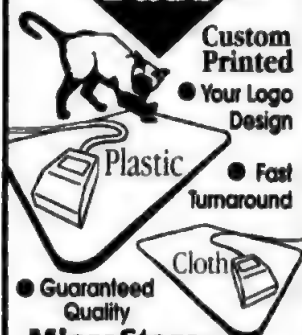
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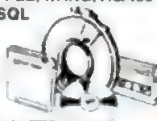
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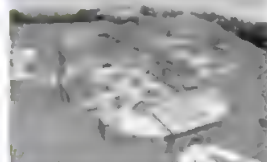
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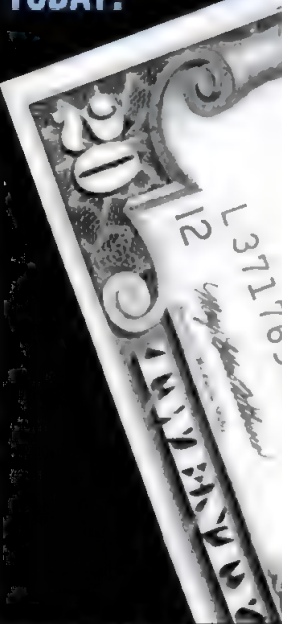
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AFTERHOURS

THE HOME SIDE OF COMPUTING

FINANCIAL & ESTATE PLANNING

Money Matters

By Kathy Yakal

Many lawyers would be happy to charge you for preparing documents outlining the disposition of your estate and for setting up power of attorney and health care directives. Fortunately, you can tackle a number of these matters yourself.

Estate planning is more than divvying up your assets, though. You also need a clear, accurate financial picture. Here we look at six software packages that can help you focus on preparing legal documents, while others can help you inventory and assess your finances. And some do both.

The packages are *Estate Planning Software Bundle*, from Nolo Press; *Kiplinger's Home Legal Advisor* and *Kiplinger's NetWealth*, both from Block Financial Corp.; *Personal Finance Fundamentals*, from ModelOffice; *Quicken Family Lawyer 99 Deluxe*, from Broderbund Software/The Learning Company; and *Quicken Financial Planner*, from Intuit. The publishers of these programs recommend that you have

complex documents reviewed by legal professionals.

Estate Planning Software Bundle

Nolo Press brings together three of its software titles in Estate Planning Software Bundle: WillMaker, Living Trust Maker, and Personal Record-Keeper. But as the name states, this is a bundle, not a suite. Consequently,

the programs are not well integrated, resulting in a collection (\$109.92 list) that leaves much to be desired, when compared with its rivals.

The first product we looked at, WillMaker, is the best of the three: Its design and content easily surpass that of its siblings. The step-by-step interviews are thorough and well documented; the program even prints final documents for your signature. It also addresses related issues such as financial power of attorney and final arrangements. If this functionality is all you need, then consider buying WillMaker separately (\$41.97).

QUICK CLIPS

Visit South Park, play chess via e-mail, and wage war in Freeport. Page 288.



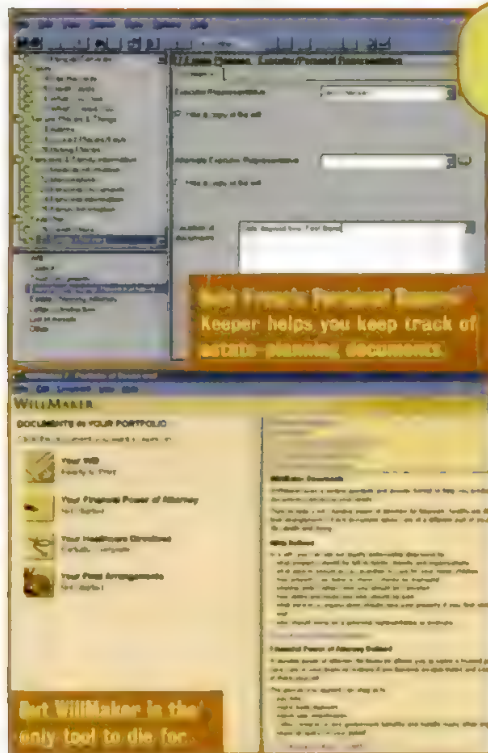
Living Trust Maker doesn't appear to have been updated recently. This does not affect the legality of the documents you create, but it does affect the user experience. You can create the same documents using Quicken Family Lawyer, which provides more guidance and explanation along the way.

The third member of the trio, Personal Record-Keeper, manages the data that its sibling programs handle. It stores your estate- and financial-planning data in simple record and report formats, rather than as documents. The program's forms templates provide a home for property and insurance records, ranging from financial accounts to investments and real estate.

The bottom line: Given the expertise of Nolo Press in self-help legal procedures, we would like to see the company keep its software up to date. As is, these programs are hard to recommend against sleek, guidance-rich competitors such as Quicken Family Lawyer 99 Deluxe.



AFTER HOURS



ESTATE PLANNING SOFTWARE BUNDLE

★★★★★ \$109.92 list. Nolo Press,
800-992-8658, www.nolo.com

example, the wizard asks you about your family composition, financial assets, and potential trustees.

A professionally prepared sample based on this information then opens in an internal mini-word processor, with some key words and phrases ("decision points," in Kiplinger's parlance) marked in red type. Double-click on one and a dialog box opens containing further guidance, an entry field, or a list of choices. After you've customized each decision point, the document is ready to print. It's as simple as that.

Other tools help ease navigation and data entry. One such tool is the Party List, which stores frequently used names, addresses, and so on; and another is the document checklist, which tells you who must sign a document, whether it must be notarized, and so forth. This program is truly a no-brainer to use, and the low cost is appealing. But Quicken Family Lawyer's additional depth, guidance, and elegance make it well worth the few extra bucks.

Although Kiplinger's Home Legal Advisor isn't specifically geared to estate and financial planning, many of its 70-plus legal document templates deal with related issues such as state-specific wills, living trusts, and power of attorney agreements. Most of its templates, though, are for generic maintenance tasks and financial planning in several categories, including real estate and health and medical. Multimedia and text-based help provide background information, and online versions of three consumer legal guides do a fine job of explaining complex legal issues.

Operation is exceedingly simple. When you first launch Home Legal Advisor, it asks a series of questions about your specific situation, then suggests a list of documents you might be wise to prepare. When you select a new document template, a wizard asks a few more questions to help personalize the document. If you're building a living trust, for

Kiplinger's NetWealth

Before deciding how to divvy up your assets, you need to look at the big financial picture. Enter Kiplinger's NetWealth, which helps you assess your financial

NetWealth runs within Microsoft Internet Explorer 4 (included on the CD-ROM); it's the only program to do so. Program options display in a vertical banner, and clicking on one of these links opens the tool in the main screen. But running the program off the Web requires an awful lot of scrolling—slow going using a 56K connection.

NetWealth offers three online

Editors' Choice

• Quicken Family Lawyer 99 Deluxe



Selecting the Editors' Choice in this group of estate-planning software tools was easy: Quicken Family Lawyer 99 Deluxe was well conceived and executed when it debuted years ago and has continued to improve ever since. Its clean, step-by-step document-preparation tools, supported by extensive legal background and search aids, provide better resources in a more stable, up-to-date interface than the competition.

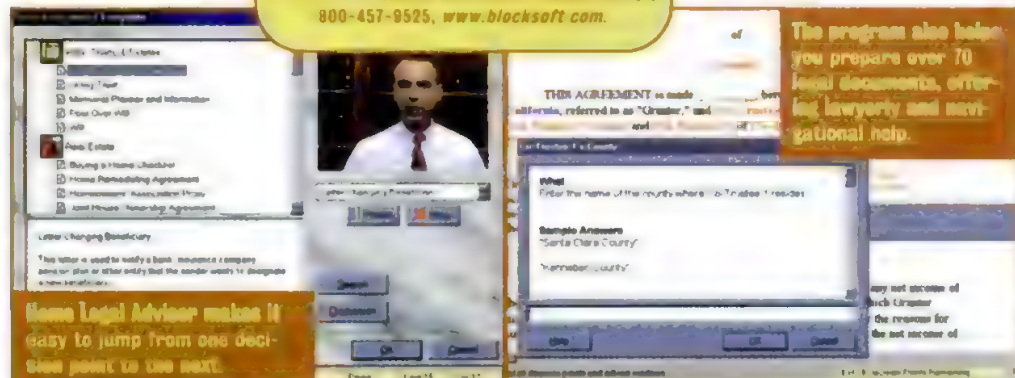
None of these programs gets the nod for basic financial planning, though. The content in Kiplinger's NetWealth looks promising, but its design and navigation need work. Quicken Financial Planner had a solid lead a few years ago but hasn't progressed much. On the other hand, personal finance software providers such as Microsoft and Quicken constantly update the Web sites they host, which may have enough resources to meet your needs.

health and helps you with short- and long-term planning for various life events. Its collection of tools, calculators, and other planning resources deal with all aspects of financial planning, from investments and credit to insurance and, alas, retirement.

help tools. Plan Builders walk you through an interactive information-gathering session, producing tables that calculate your current and projected net worth and your retirement solvency. An interactive calculator zeros in on your short-term financial goals (a vacation, second home, or new car). And a what-if calculator lets you ex-

KIPLINGER'S HOME LEGAL ADVISOR

★★★★★ \$29.95 list. Black Financial Corp.,
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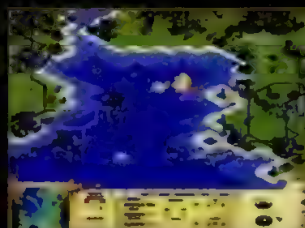
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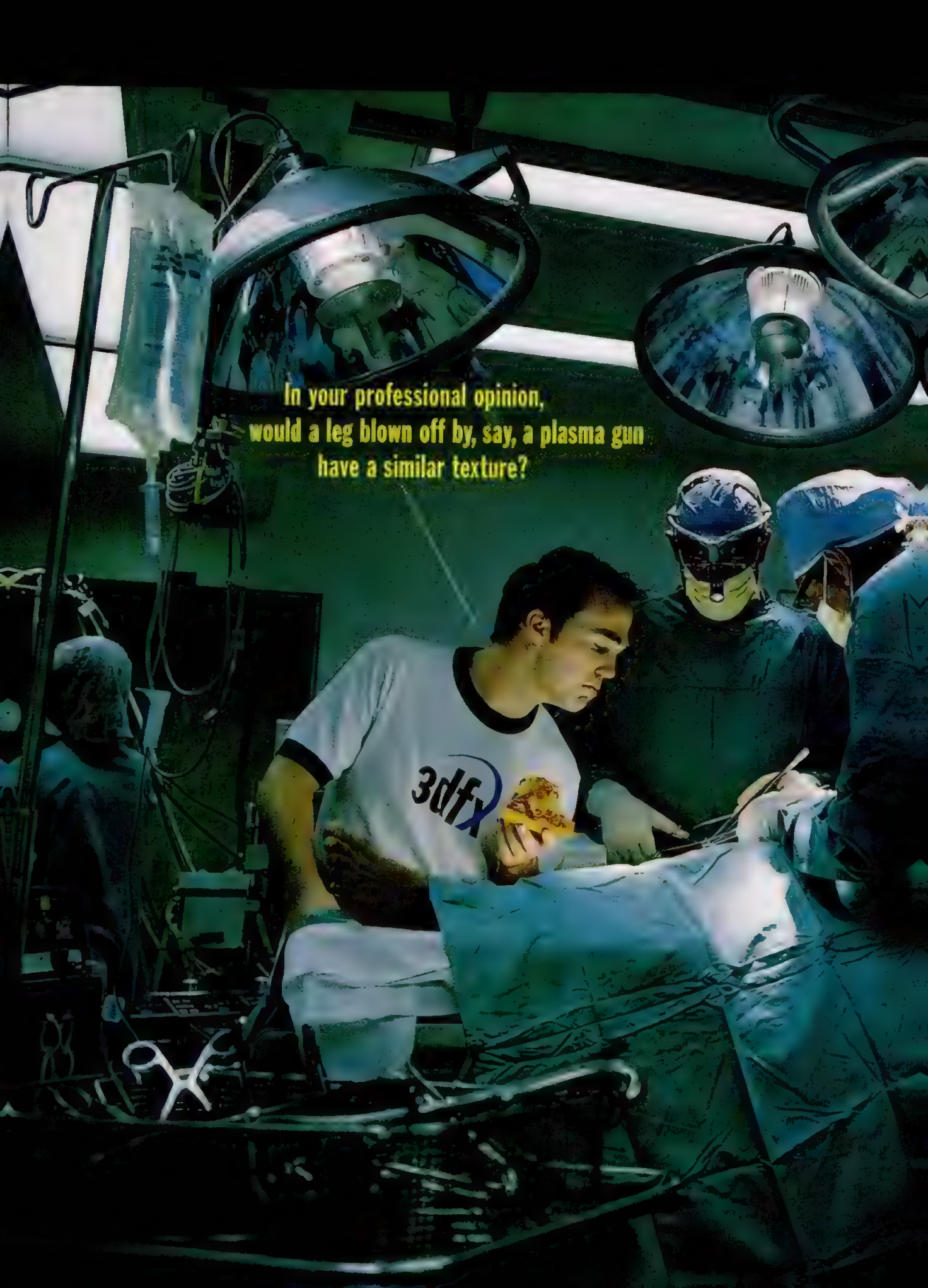
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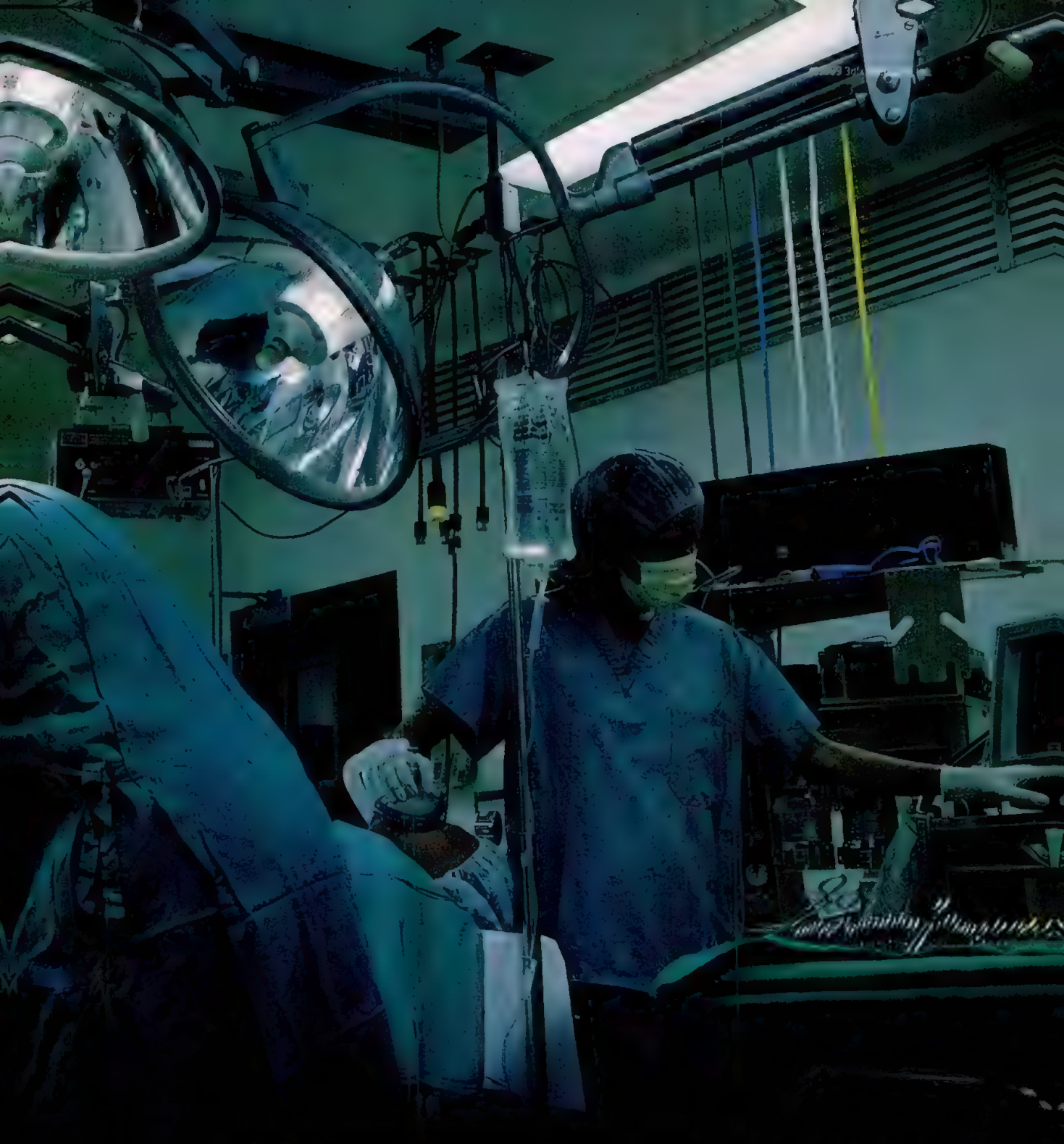
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A man in a white t-shirt with a blue '3dfx' logo is sitting in an operating room. He is looking down at a surgical site. Two surgeons in blue scrubs and masks are standing behind him, one holding a surgical instrument. The room is dimly lit, with large overhead surgical lamps. A drip chamber is visible on the left. The overall tone is serious and clinical.

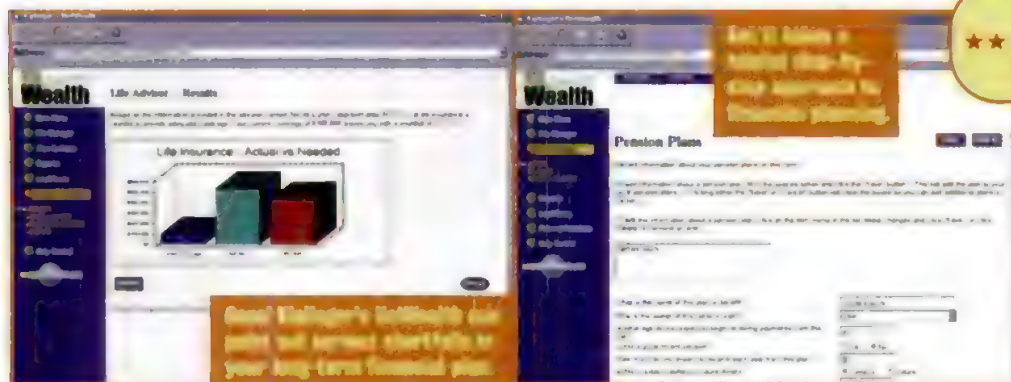
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KIPLINGER'S NETWEALTH
★★★★★ \$39.95 list. Block Financial Corp.,
800-451-9525, www.blocksoft.com

plore various financial scenarios.

Additional interactive advisors collect information and make projections and recommendations in such areas as life insurance, asset allocation, credit reduction, and taxes. A handful of reports—like a simple cash flow analyzer—offer a bird's-eye view of the big financial picture. Limited Web integration enhances the static information in the program. For example, you can update your portfolio with current stock quotes.

Though NetWealth has potential, its financial-planning tools and software are neither innovative nor particularly well executed. Buy some of Kiplinger's financial publications and do your interactive planning elsewhere.

Personal Finance Fundamentals

As its name says, this program covers the fundamentals of personal finance—and then some. It pulls together a vast array of resources and tools, offering over 2,000 guidelines, tips, spreadsheets, checklists, and sample letters on such issues as personal banking, credit, investments, insurance, taxes, pensions, retirement, and the IRS. The program does not go out of its way to make the user experience cohesive or quick, but it certainly packages a wealth of information.

The core program uses a Windows Explorer-like interface, which displays an outline along the side and corresponding files in the center. The collapsible out-

line is enormous. You can read some entries, such as the letters and checklists, on-screen. But printing and modifying them takes some work: For example, you have to select and copy a sample letter to your word processor to work with it.

To open checklists and worksheets for data entry or printing, you'll have to use an external editor (anything that can handle RTF files will work). The outline contains some skimpy explanations of the included spreadsheets, and even these must be opened with an external program.

The list of estate-planning features includes a worksheet for recording information about your estate, an estate-liquidity analysis worksheet, and an estate-planning checklist. But there is nothing to help you prepare a will or other legal documents.

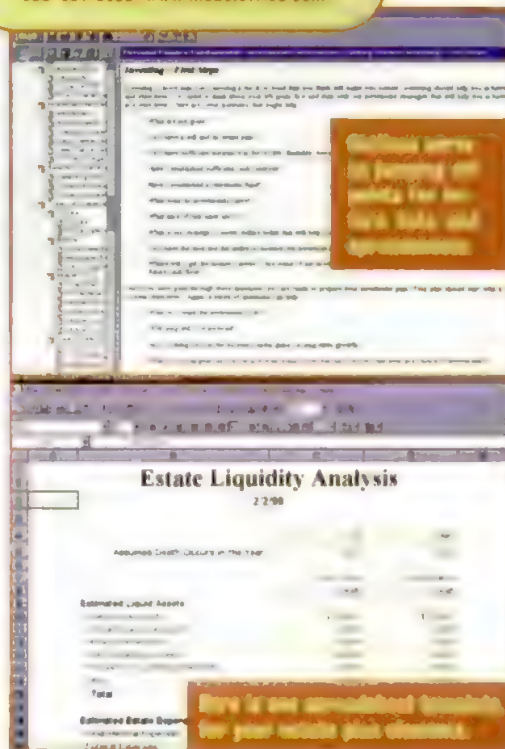
Although it does not earn high marks for ease of use, Personal Finance Fundamentals is not a bad resource given the breadth of components it provides: At \$29.95 list, it's worth having on hand. But other software developers have made greater efforts to integrate and simplify the personal financial-planning process.

Quicken Family Lawyer 99 Deluxe



Quicken Family Lawyer 99 Deluxe is the next-best thing to having a lawyer in the family. This suite of legal software can handle all aspects of estate and financial planning. It includes the popular Quicken Family Lawyer (which has customizable templates for over 100 legal documents), The American

PERSONAL FINANCE FUNDAMENTALS
★★★★★ \$29.95 list. MadeOffice Inc.
800-801-3880, www.madeoffice.com



Bar Association Family Legal Guide, The Plain Language Law Dictionary, and the program Estate Planner.

The core tool, Quicken Family Lawyer, uses step-by-step interviews to determine which legal documents you need before it solicits the data required to complete them. Legal resources are available at any Q&A screen; you can also browse through the extensive legal library.

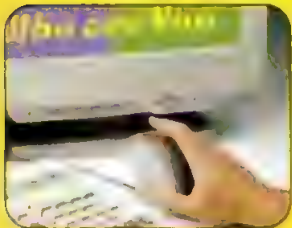
The Estate Planner add-in (which is also sold separately) uses a combination of Q&A forms, worksheets, and tutorials to teach you what estate planning entails and what you need to do to prepare. Estate Planner stops short of preparing legal documents, but Quicken Family Lawyer can produce the primary ones you're likely to need: wills, living trusts, power of attorney forms, and health care directives. The program also lets you link to a Web site (www.itslegal.com), where you can access Law Crawler (a specialized, law-related search engine), legal links, and a lawyer locator (to locate attorneys in your area).

At press time, Broderbund was preparing to launch Quicken Family Lawyer 2000 Deluxe (\$29.95 list). This new version should contain, among other things, many new documents, video help, and a sleeker, revamped interface. Even without the renovations, Quicken Family Lawyer 99 Deluxe is our favorite estate planner, thanks to its effective combination of program- and Web-based legal resources, depth, and consumer-friendliness. Unless you have a vast, extraordinarily complex estate, Quicken Family Lawyer 99 Deluxe should fill the bill.

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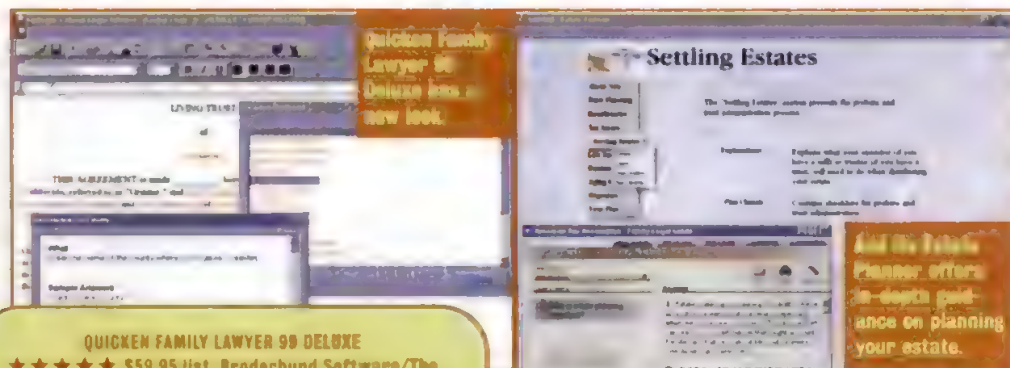
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★★★★★ \$59.95 list. Broderbund Software/The Learning Company, 800-779-6000, www.shoptlc.com.

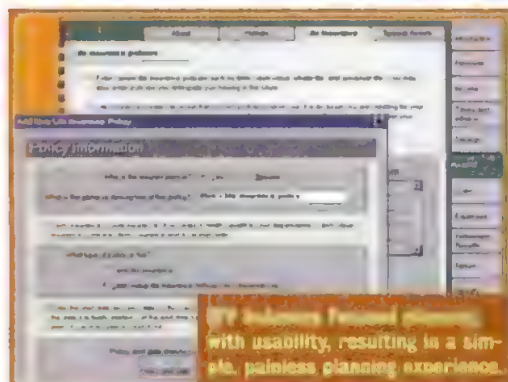
Quicken Financial Planner

Intuit's personal finance products are popular and successful, because they make complex, cumbersome processes understandable and manageable. Quicken Financial Planner is no exception. It can walk you through the process of defining your financial universe and goals in an hour (assuming you have the required figures handy), spitting out an assessment of your financial plan's potential success—or lack thereof.

Labeled tabs along the top

and side of the program window indicate how far along you are in the planning process; Back and Next buttons move you step by step through the linear path. You can choose either an abbreviated

journey or the full plan. The latter divides its tasks into categories such as Income, Taxes and Inflation, Assets, Expenses, and Return (on investment). Also, Quicken users can import data to simplify the process.



with usability, resulting in a simple, painless planning experience.

The product has surprisingly little interaction with outside resources or the Web. QFP offers expert guidance and is linked to Intuit's online Mutual Fund Finder, but that's about it.

Once you've answered all the questions you can, QFP displays its analysis of your financial plan in several screens, using charts and text. If you come up lacking, you can try out some what-if scenarios or go back and alter your plan. The program also lays out suggested action steps to help you get (or stay) on course. This is "lite" financial planning, but it's superbly done. **PC**

QUICKEN FINANCIAL PLANNER
★★★★★ \$39.95 list. Intuit Inc., 800-224-0991, www.intuit.com



details of your financial plan.

Online Estate-Planning Resources

Sure, desktop financial software's been around longer, but Web sites are catching up and occasionally surpassing their shrink-wrapped cohorts. As a result, you can find an awful lot of expert financial-planning advice on the Web—much of it for free.

Your first online stop should be MSN MoneyCentral (www.moneycentral.com), an excellent resource. Tools, articles, Q&A sections, and step-by-step guides are well researched and well presented.

Quicken.com (www.quicken.com) provides the same kind of interactive guidance that made its desktop counterpart so popular. Its blend of editorial content, interactive tools, discussion forums, and other resources related to financial planning is top-notch.

Nolo Press and Broderbund both host sites full of legal information and guidance that complement their self-help legal products. The Nolo and Broderbund sites are at www.nolo.com and www.itslegal.com, respectively.

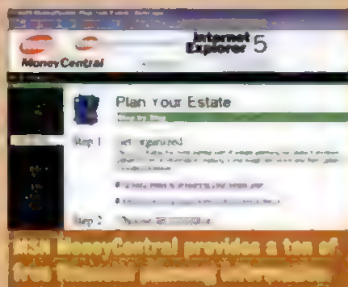
Some of the best research sites provide little apart from links to other sites that cover specific issues. For financial and estate planning, check out EF Moody (www.efmoody.com), InvestorGuide

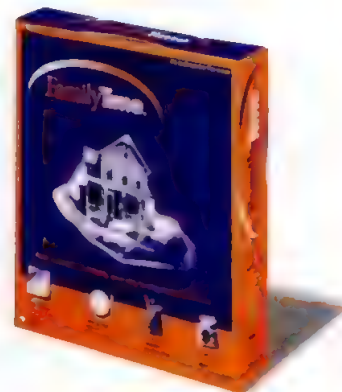
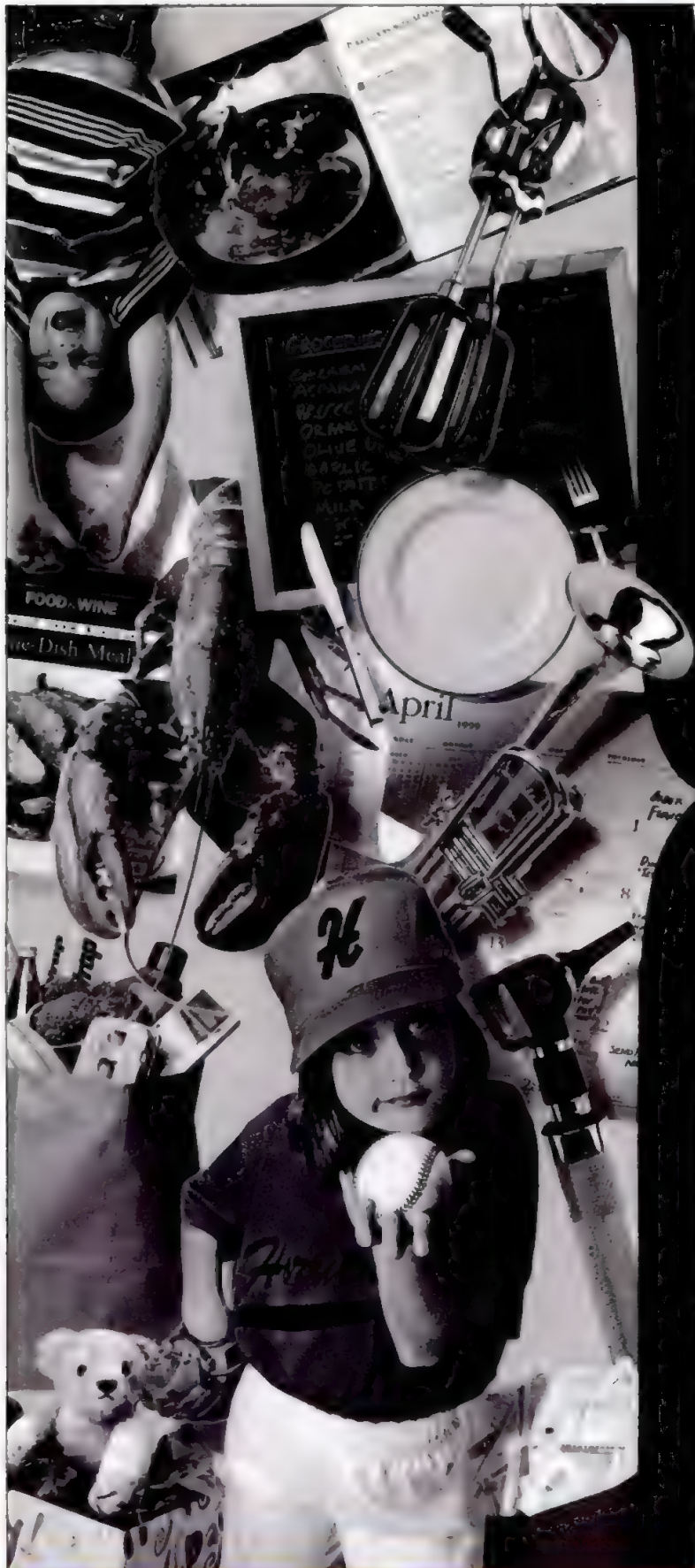
(www.investorguide.com), and The Mining Company (pfinance.miningco.com). Many, many sites provide a wealth of information and tools for general financial planning; these include Armchair Millionaire (www.armchairmillionaire.com), Financenter.com (www.financenter.com), Kiplinger.com (www.kiplinger.com), Money Magazine (www.money.com), Women's Wire (www.womenswire.com/money), and Yahoo! Finance (finance.yahoo.com).

Some financial institutions provide free guidance online. Deloitte & Touche (www.dtonline.com) is especially helpful, publishing a voluminous estate-planning guide, as well as publications on estate and gift taxation. Information and interactive tools are also available at Vanguard's Retirement Resource Center (www.vanguard.com).

Some law firms and other professional organizations serve as online information providers

(where they also promote their paid services). They offer Q&A sections, checklists, access to educational resources such as books and pamphlets, and so on. Some examples: The Estate Preservation Alliance (www.tepa.com), Legal Survival (www.frfran.com), and Robert Ciofine's Estate Planning Page (www.estateattorney.com).





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You play these games with a friend via e-mail: Make your move, e-mail it to your opponent, and he or she does the same. Inexpensive and well designed, they nevertheless fare poorly beside the many free, real-time online chess, checkers, and backgammon games on the Web. \$14.95 list; Hasbro Interactive Inc., 800-400-1352, www.hasbro-interactive.com.

Redline

A dark, violent action game about futuristic gang warfare, Redline combines excellent 3-D graphics with fast-paced action that takes place both on foot and in heavily armed vehicles (à la *Mad Max*). Though not for young players, serious action fans seeking something different should check it out. \$39.95 list; Accolade Inc., 800-245-7744, www.accolade.com.

Sierra Complete LandDesigner

Sierra Complete LandDesigner is a fine resource for the home-improvement crowd: It's a five-in-one bundle that includes Garden Encyclopedia, LandDesigner 3D, Personal Garden Planner, Photo LandDesigner, and 3D Deck. Though these apps are not integrated, the package offers a wealth of information, guidance, and 3-D visualization tools. \$49.95 list; Sierra Home, 800-757-7707, www.sierrahome.com.



South Park

Acclaim's 3-D first-person game is a faithful adaptation of the popular, irreverent cartoon; you'll face a barrage of profanity and mature humor that is inappropriate for kids. But that's the least of its problems: The uninspiring graphics and simplistic, repetitive action make for a highly disappointing game. \$39.99 list; Acclaim Entertainment Inc., 800-656-5443, www.acclaim.net.

Wages of Sin

An add-on pack for Activision's SiN first-person action game, Wages of Sin fixes many bugs in the original and provides 17 new missions of fast-paced shoot-'em-up action. This time, you're out to stop a gang trying to take over the violence-plagued city of Freeport. Great graphics and a superb multiplayer mode make this a must-have. \$29.99 list; Activision Inc., 310-255-2000, www.activision.com.



WebSpice Deluxe

This expensive, Web-specific clip-art collection offers thousands of royalty-free images, animations, and Web page templates. Most of the images are customizable, and the level of quality is decent, but for the hefty price tag we expected better. \$249 list; DeMorgan Industries Corp., 203-431-6661, www.webspice.com.

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Coming Up

What's in the Next Issue of *PC Magazine*

Peek into the Future!

PC Magazine's special report on the future of computing will identify the ten key trends driving computing innovation into the next millennium. Our editors will explore how these technologies are likely to affect everything you do—from the way you work, play, and surf the Web to how you interact with your PC and do your shopping. We'll also show you where you can try out tomorrow's technologies today.

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With corporate PCs, blazing performance and cutting-edge components are not as important as reliability, manageability, and service and support. Keeping that in mind, *PC Magazine Labs* will test ten corporate desktops to see which vendors simplify the job of purchasing, managing, and maintaining hundreds or even thousands of networked PCs.

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A new class of server is taking the small-business market by storm. These small, dedicated systems with embedded OSs claim to make it painless to set up Web and mail services on small networks. *PC Magazine Labs* will test seven servers to see whether they deliver.



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28 E. 28th St.
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New York, NY
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212-503-5100

Display Advertising

Nancy Newman
Senior Vice President
Publishing Director
(212) 503-4453

Vickie Pinsky
Associate Publisher
(212) 503-5651
vickie_pinsky@zd.com

Mike Kisseberth
Associate Publisher
National Accounts
(415) 547-8809
mike_kisseberth@zd.com

Cameron Brown
Associate Publisher
East Coast
(781) 393-3058
cameron_brown@zd.com

Tim Castelli
Associate Publisher
West Coast
(415) 547-8810
tim_castelli@zd.com

Ad Systems Manager
Julie Eigo
(212) 503-5107
julie_eigo@zd.com

Advertising Coordinator
Jennifer Kim
(212) 503-5037
jennifer_kim@zd.com

East Coast
Account Coordinator
Tara Mulligan
(212) 503-5163
tara_mulligan@zd.com

West Coast
Account Coordinator
Tricia Bond
(212) 503-5023
tricia_bond@zd.com

MA, NH, VT, ME, RI

District Sales Manager
Lynne Montesanto (781) 393-3055
lynne_montesanto@zd.com
10 President's Landing
Mystic Center
Medford, MA 02155

Account Representative
Noah Heller (212) 503-4579
noah_heller@zd.com

NY

East Coast Area Manager
Thomas Koletas (212) 503-3703
thomas_koletas@zd.com
28 E. 28th St., 12th Floor
New York, NY 10016-7930

Account Representative
Noah Heller (212) 503-4579
noah_heller@zd.com

AL, AR, CT, FL, GA, KY, NC, NY, SC, TN

District Sales Manager
Julie Zuckerman (212) 503-5029
julie_zuckerman@zd.com
28 E. 28th St., 12th Floor
New York, NY 10016-7930

Account Representative
Dorrie Gordon (212) 503-3809
dorrie_gordon@zd.com

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District Sales Manager
Jason Webby (212) 503-5024
jason_webby@zd.com
28 E. 28th St., 12th Floor
New York, NY 10016-7930

Account Representative
Dorrie Gordon (212) 503-3809
dorrie_gordon@zd.com

WI, IL, MN, MI, IA, ND, SD, TX, OK, LA,
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Regional Sales Manager
Jeff Kamikow (312) 214-7353
jeff_kamikow@zd.com
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Chicago, IL 60606

CA: Los Angeles, HI, NV

District Sales Manager
Stephanie Sload (310) 268-1381
stephanie_sload@zd.com
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daniel_contento@zd.com
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CA: San Jose, Campbell, Los Gatos, Saratoga,
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Northern California Area Manager
Brian Gleason (415) 547-8816
brian_gleason@zd.com
50 Beale Street, 13th Floor
San Francisco, CA 94105

Account Representative
David Kaye (212) 503-5113
david_kaye@zd.com

CA: San Francisco & North, WA,
BC, OR, ID

District Sales Manager
Jordan Klineman (415) 547-8807
jordan_klineman@zd.com
50 Beale Street, 13th Floor
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Account Representative
Charise Rohm (212) 503-5138
charise_rohm@zd.com

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District Sales Manager
Jason Ratner (415) 547-8813
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San Francisco, CA 94105

Account Representative
Charise Rohm (212) 503-5138
charise_rohm@zd.com

Taiwan Advertising Representative

The InfoPro Group
Ann Wu, Sales Manager
International Business Department
Tel: 886-2-27153000/369
DID: 886-2-25470635
Fax: 886-2-25470634

Marketplace Advertising

Vicki Egan
Production Director

Gretchen Vitamvas
Senior Production Coordinator

Christina Alegria
Advertising Coordinator
(212) 503-5012
christina_alegria@zd.com

West Coast, AZ, CA, CO, HI, ID, MT, NV, NM,
OR, UT, WA, WY

Account Representative
Rick Herman (212) 503-5133
rick_herman@zd.com

Southeast, AL, AR, FL, GA, KS, KY, LA, MS, MO,
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Account Representative
Amy McCormack (212) 503-3699
amy_maccormack@zd.com

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IBM/Cyrix 6x86	PR366	64MB	8GB	17"	\$849.99	(CTQTM23)
AMD K6-2	333MHz	96MB	10GB	17"	\$909.99	(CTQTM26)
AMD K6-2	350MHz	128MB	10GB	17"	\$959.99	(CTQTM35)
Intel Pentium II	350MHz	64MB	6.4GB	17"	\$969.99	(CTQTM11)
AMD K6-2	400MHz	128MB	10GB	17"	\$999.99	(CTQTM37)
Intel Pentium II	400MHz	96MB	10GB	17"	\$1129.99	(CTQTM12)
AMD K6-3 w/256K cache	400MHz	128MB	12GB	17"	\$1219.99	(CTQTM39)
Intel Pentium III	450MHz	128MB	13GB	17"	\$1259.99	(CTQTM42)
Intel Pentium III	500MHz	128MB	13GB	17"	\$1489.99	(CTQTM43)

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571 Pre-Assembled Kits: Motherboard in midtower case, 512K Cache, keyboard, speakers, mouse, 56K modem, 1.44MB floppy, 24X CD-ROM. Sound and PCI video with 4MB onboard.

598 Pre-Assembled Kits: Motherboard in midtower case, 1MB Cache, keyboard, mouse, 56K modem, 1.44MB floppy, and 24X CD-ROM. Sound and AGP video with 8MB onboard.

Tiger 573 Form Factor: AT • CPU: Socket 7 • Bus Speed: Up to 75MHz • OnBoard Video: No • OnBoard Audio: YES • PCI Slots: 4 • ISA Slots: 2 • Memory: 2DIMM/4SIMM • Max Memory: 128/256 MB

Tiger 571 Form Factor: AT • CPU: Socket 7 • Bus Speed: Up to 75MHz • OnBoard Video: PCI 4MB • OnBoard Audio: YES • PCI Slots: 4 • ISA Slots: 3 • Memory: 2DIMM/4SIMM • Max Memory: 128/256 MB

Tiger 598 Form Factor: AT • CPU: Super Socket 7 • Bus Speed: Up to 100MHz • OnBoard Video: AGP 8MB • OnBoard Audio: YES • PCI Slots: 3 • ISA Slots: 2 • Memory: 3DIMM • Max Memory: 768 MB

Tiger 6KE LX, 68A+ BX Slot 1 With AGP

Motherboard & Case: Motherboard mounted in dual-cooling fan case, 200 Watt p/s, cable & manual.
Pre-Assembled Kits: Motherboard in midtower case, keyboard, speakers, mouse, 56K modem, 1.44MB floppy, 24X CD-ROM. Sound and AGP video card.

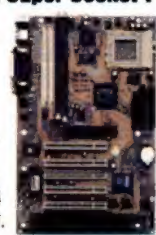


FREE FLOPPY DRIVE!

Tiger 6KE LX Form Factor: ATX • CPU: Slot 1 • Bus Speed: Up to 66 MHz • PCI Slots: 4 • ISA Slots: 3 • Memory: 3DIMM Sockets • Max Memory: 384 MB
Tiger 68A+ BX Form Factor: ATX • CPU: Slot 1 • Bus Speed: Up to 100MHz • PCI Slots: 5 • ISA Slots: 2 • Memory: 4 DIMM Sockets • Max Memory: 1024 MB

Tiger 5EMA+ ATX Super Socket 7

Motherboard & Case: Motherboard mounted in ATX case with 1MB Cache, 235-watt p/s, cables, manual.
Pre-Assembled Kits: Motherboard in dual-cooling fan case; keyboard, speakers, mouse, 3D AGP video, 56K modem, 1.44MB floppy drive, 24X CD-ROM. Wave Table sound.



Tiger 5EMA+ Motherboard Features At-A-Glance
Form Factor: ATX • CPU: Socket 7 • Bus Speed: Up to 100 MHz • AGP Slots: 1 • PCI Slots: 5 • ISA Slots: 2 • Memory: 3DIMM Sockets • Max Memory: 768MB

Tiger 767 AT, 760 ATX Slot 1

Motherboard & Case: Motherboard mounted in dual-cooling fan case; cables & manual.
Pre-Assembled Kits: Motherboard in dual-cooling fan case; keyboard, speakers, mouse, 3D AGP video, 56KFlex faxmodem, 1.44MB floppy, 24X CD-ROM. Wave Table sound.



Tiger 767 Form Factor: AT • CPU: Slot 1 • Bus Speed: Up to 100 MHz • OnBoard Video: 8MB AGP • OnBoard Audio: YES • PCI Slots: 4 • ISA Slots: 1 • Memory: DIMM • Max Memory: 768 MB
Tiger 760 Form Factor: Micro ATX • CPU: Slot 1 • Bus Speed: Up to 100MHz • OnBoard Video: 8MB AGP • OnBoard Audio: YES • PCI Slots: 3 • ISA Slots: 1 • Memory: DIMM • Max Memory: 768 MB

MOTHERBOARD SPECIFICATIONS

Motherboard Design	Processors Supported
Tiger 571 AT including Wave Table sound and PCI video	AMD Up to K6-300 & K62-266 Intel Pentium up to 233 MMX IBM/Cyrix up to P3300
Tiger 573 AT including Wave Table sound	AMD Up to K6-300 & K62-266 IBM/Cyrix up to P3300; Intel Pentium up to 233 MMX
Tiger 598 AT including 1MB Cache, Wave Table sound and PCI video	AMD Up to K6-2450; K6-3400 Intel Pentium up to 233 MMX IBM/Cyrix up to P3366
Tiger 5EMA+ Super Socket 7 1MB Cache	AMD Up to K6-2450; K63-400 Intel Pentium up to 233 MMX IBM/Cyrix up to MII 366
Tiger 767 AT Slot 1 with Sound & AGP video	Celeron up to 433MHz Intel Pentium III up to 500MHz
Tiger 760 Micro-ATX Slot 1 w/Sound & AGP video	Celeron up to 433MHz Intel Pentium III up to 500MHz
Tiger 6KE LX ATX Slot 1	Celeron up to 433MHz Intel Pentium III up to 333MHz
Tiger 68A+ BX ATX Slot 1	Celeron up to 433MHz Intel Pentium III up to 550MHz

MOTHERBOARD ONLY

Item No.	1-2 Units	3-5 Units	6+ Units
MB1-C-1B	\$75.99	\$70.99	\$65.99
MB1-E-8A	\$49.99	\$44.99	\$39.99
MB1-E-9A	\$82.99	\$79.99	\$75.99
MB1-T-7B	\$74.99	\$72.99	\$69.99
MB1-E-5A	\$97.99	\$95.99	\$91.99
MB1-E-6A	\$96.99	\$94.99	\$91.99
MB1-T-10A	\$42.99	\$40.99	\$38.99
MB1-T-9B	\$84.99	\$82.99	\$79.99

MOTHERBOARD & CASE

Item No.	1-2 Units	3-5 Units	6+ Units
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BB1-E-8A	\$94.99	\$92.99	\$89.99
BB1-E-9A	\$139.99	\$135.99	\$129.99
BB1-C-2D	\$149.99	\$144.99	\$137.99
BB1-E-5A	\$154.99	\$150.99	\$144.99
BB1-E-6A	\$139.99	\$135.99	\$129.99
BB1-T-10A	\$109.99	\$107.99	\$103.99
BB1-T-9A	\$149.99	\$145.99	\$139.99

PRE-ASSEMBLED KITS

Item No.	1-2 Units	3-5 Units	6+ Units
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#CP2-K62-400 400 3DNow!	\$122.99	\$117.99	\$113.99*
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#CP2-K63-400 400 3DNow!	\$279.99	\$269.99	\$258.99*

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#CP2-6X333 MII 333 CPU	\$47.99	\$42.99	\$40.99*
#CP2-6X366 MII 366 CPU	\$72.99	\$69.99	\$65.99*
#CP2-P233 Pentium 233 CPU	\$62.99	\$59.99	\$57.99

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#CP2-C1366 Intel Celeron 366 processor***	\$75.99	\$73.99	\$71.99
#CP2-C1400 Intel Celeron 400 processor***	\$119.99	\$115.99	\$109.99
#CP2-C1466 Intel Celeron 466 processor***	\$194.99	\$184.99	\$179.99
#CP2-P2-400 Intel Pentium II 400 processor*	\$269.99	\$259.99	\$249.99
#CP2-P3-450 Intel Pentium III 450 processor*	\$309.99	\$294.99	\$284.99
#CP2-P3-500 Intel Pentium III 500 processor*	\$549.99	\$529.99	\$509.99
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FROM \$37.99

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TC1-MEM-64	64MB PC100 SDRAM	\$79.99	\$76.49	\$74.49
TC1-MEM-128	128MB PC100 SDRAM	\$159.99	\$154.99	\$149.99

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Item #	Manufacturer	Size	Units 1-2	3-5	6+
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THD-4A	Seagate	4.3GB	\$120.99	\$118.99	\$115.99
THD-6C	Seagate	6.4GB	\$134.99	\$132.99	\$129.99

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The Tiger AT, ATX, and ATX Server Cases all include a mid-tower, dual-cooling fan design

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CA1-C-2A	ATX Case 6-Bay 235-W.P.S.	\$58.99	\$54.99	\$51.99
CA1-M-5A	ATX Server 6-Bay 300-W.P.S.	\$124.99	\$119.99	\$115.99

Sorry, but as prices are always changing on CPUs and memory, we do not offer price protection in the event prices rise or fall. *Requires 100MHz bus motherboard and 6ns PC100 SDRAM Memory. ** Requires 95MHz bus motherboard and 6ns PC100 SDRAM. † CD-ROM speeds are variable, maximum speeds are shown. †† Requires 63MHz bus motherboard. Call us for details and warranty information. No returns accepted on CPUs.

abort. retry. fail?

THE LIGHTER SIDE OF
PERSONAL COMPUTING

Edited by Don Willmott



Here, someone attaches a maple syrup bucket to a telephone pole. Such is humor in the Internet era.

(Southbury
[Connecticut]
Voices ad.)



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Y2K Compliant

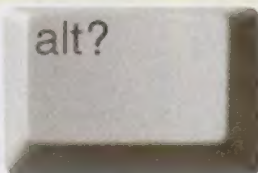
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PATRIOT

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Bruce Willis: Jackal or Jackass?

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"I'm ordering our new PC. Do you want it left-brain or right-brain-oriented?"

If your entry is used, we'll send you \$50 and a *PC Magazine* T-shirt. Send your entries to Abort, Retry, Fail?, *PC Magazine*, 28 E. 28th St., New York, NY 10016-7930. Winners this issue: Stevor Compton, Bill Kamm, Gad Malamed, John Meyers, Fred Richards, and Burton Schaefer.

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- 3D Surround Sound with Wavetable
- Lithium Ion Battery
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- Microsoft Windows® 98
- Touchpad
- 3-Year Limited Warranty³
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